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ENGINEERING NEWS-RECORD

RUARY 20, 1947

Survey and Forecast Number

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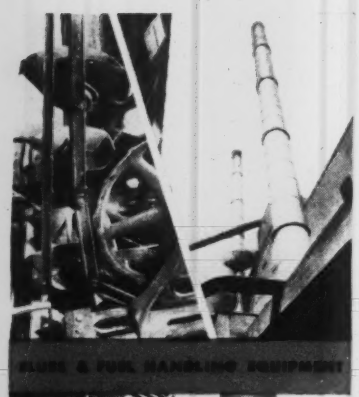
IN THESE CORROSIVE SERVICES



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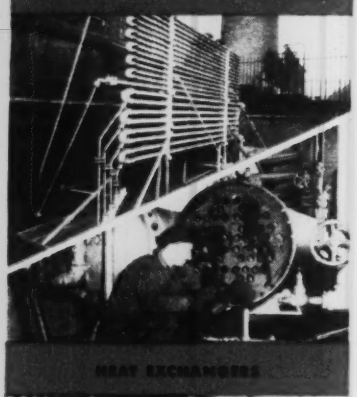

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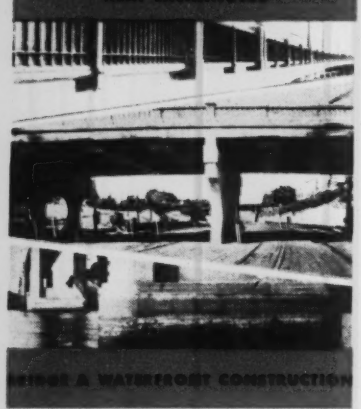

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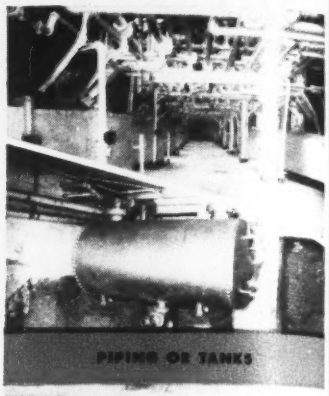

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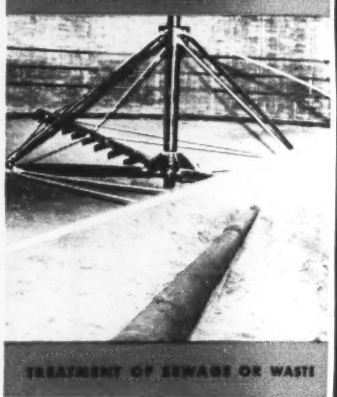

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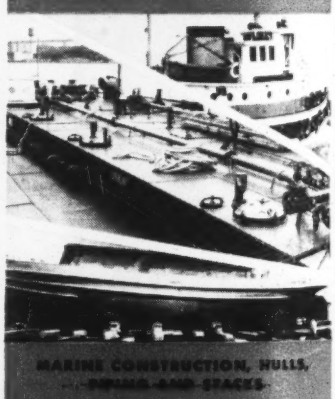

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Volume 138 • Number 8 February 20, 1947

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ATLANTIC REFINING CO.—Philadelphia, Pa.
Button Bottom Piles, footage 120,000

CADILLAC MOTOR CO.—Chicago, Ill.
Button Bottom Piles, footage 20,101
Pipe Pile Composites, footage 22,485

PETER CAILLER KOHLER SWISS CHOCOLATE—Fulton, N. Y.
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News of the Week

ENGINEERING NEWS-RECORD • FEBRUARY 20, 1947 • VOLUME 138 • NUMBER 8

Federal-aid hospital plan moves toward action stage

Surgeon-general issues regulations governing construction and distribution of civil hospitals as step in activating $1.1 billion building program

Regulations to govern the nationwide federal-state hospital construction program were issued last week by the office of Surgeon-General Thomas Parran, covering type, size and distribution of hospitals; general standards of construction and other matters.

The program, created by the Hospital Survey and Construction Act of Aug. 13, 1946, permits appropriations up to $3,000,000 to assist the states in surveying and planning hospital needs, and $75,000,000 annually for the next five years to aid in the construction of hospitals and health centers. Nearly all of the survey fund has been appropriated, but no money has yet been appropriated for construction—pending requests to Congress for such funds.

Although administration of the hospital program is left primarily to the states, the law specifies that regulations must be prescribed by the Surgeon-General, with the approval of the Federal Security Administrator and the Federal Hospital Council.

Government gives one-third

Under the act, the federal government will supply a flat 33⅓ percent of the cost of planning, with allocations being made on a straight population basis. On construction projects, the U. S. will also supply one-third the cost of approved projects, but the amount of aid given the various states is based on a complicated formula giving weight to both the state's population and the average per capita wealth of the citizens of that state in comparison to the nationwide average.

The act requires that the cities and local governmental units work through a state hospital agency to obtain federal aid in much the same manner as federal-aid funds are handled.

At present, the states are making surveys of their hospital needs, but to date, no state has completed this work sufficiently to forward a program to Washington. For this reason, the PHS is not requesting and not receiving any applications for construction assistance.

When construction money does become available, the aim is to have local groups apply to the Surgeon General through the state agencies and the regional offices of PHS. In each of these latter offices, an engineer, an architect and whatever other staff is needed, will be available to assist applicants.

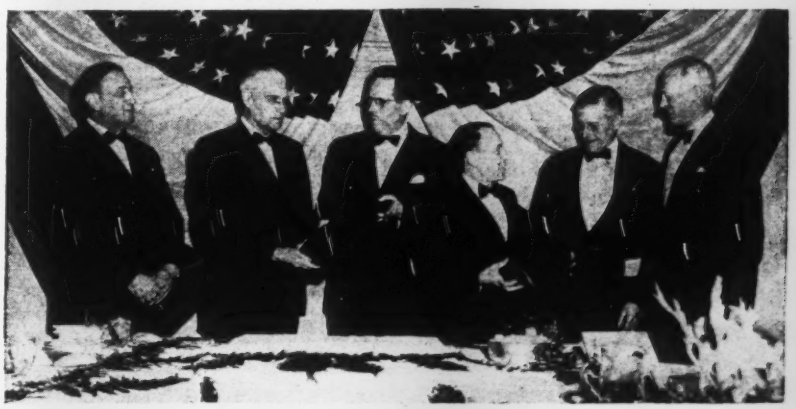
The overall program is being supervised by the division of hospital facilities of PHS.

Public Health Service officials considers the hospital program as a $1,125,000,000 program, spread over the next five years. Of this amount, Congress will provide $375,000,000.

The regulations, in adition to prescribing size and type, construction, and state administration methods, also incorporate other requirements. Under the act, the distribution of beds among base, intermediate and urban areas ranges from 4.5 to 5.5 beds per 1,000 population, depending on state population density. Regulations further specify distribution from 2.5 beds per 1,000 population in rural areas to 5.5 beds per 1,000 in base areas. Maximum beds for tuberculosis patients will be 2.5 times the average annual deaths from that disease in the state over the 5-year period 1940-44; 5 per 1,000 population for mental patients, and two per 1,000 for chronic disease patients.

The number of public health centers is not to exceed one for each 30,000 population, except in states where population is less than 12 per square mile—one center to each 20,000 persons.

Complete regulations were published in the *Federal Register* and reprints are available through the Public Health Service, Washington, D. C.



***Moles Present Construction Awards**—Award for outstanding achievement in heavy construction, made annually by the Moles, a New York City organization of construction men, went this year to Harry W. Morrison of Morrison-Knudsen Co. Inc., Boise, Idaho and to Thomas Crimmins of New York City (ENR Dec. 19, vol. p. 832). Left to right above are Ben Moreell who presented the award to Mr. Morrison (next right), Carlton Proctor, chairman of the Moles Award Committee, A. N. Warwick, president of the Moles, Mr. Crimmins, and J. Rich Steers, Jr.*

NEWS IN BRIEF

In telegraphic form, here are latest news developments on the engineering and construction front during the week.

Industrial construction—Work has started on a $2,000,000 addition to the Central Soya division of the McMillen Feed Mills, *Gibson City, Ill.* . . . Ground has been broken for the $10,000,000 Corn Products Refining Co. plant at *Corpus Christi, Tex.* . . . Lion Oil Co. is spending over $2,500,000 for additions and improvements to its chemical plant and refinery at *El Dorado, Ark.* . . . CPA has approved expansion of the Crucible Steel Co. of America plant at *Midland, Pa.*, to cost $1,714,180 . . . Southern New England Telephone Co. has plans for an expenditure of $16,000,000 this year in central exchange and office buildings in *Winsted, West Haven, Norwalk, New Britain, Stamford, Meriden, Stratford, Danielson, Bristol* and *East Hartford, Conn.* . . . Reichold Chemicals, Inc., plans a 5-year, $5,000,000 expansion program at its phenol plant at *Tuscaloosa, Ala.* . . . Sonoco Products Co. plans the construction of a $1,300,000 corrugated paper board mill at *Hartsville, S. C.*

Power plant construction—Preliminary construction has started on the first $7,000,000 steam generating unit of a power and light plant of the Public Service Co. of Indiana to be located four miles north of *Noblesville, Ind.* . . . The Indianapolis Power & Light Co. has been authorized to begin construction of a generating plant on White River 18 miles southwest of *Indianapolis, Ind.* . . . Carolina Power & Light Co. plans a 1947 construction budget of over $6,700,000, the largest item being $2,200,000 for 1,500 miles of rural lines in *North Carolina.* . . . The South Carolina Electric and Gas Co. has applied for a permit to build a $4,000,000 hydro-electric generation plant on the Saluda River in *South Carolina.* . . . The Ohio Edison Co. in the last ten months has announced plans for new developments to cost $20,820,000, the latest being a $14,000,000 expansion at *Toronto, Ohio.* . . . Public Service Corp. of New Jersey will spend $23,000,000 in expansion of electric facilities and $7,900,000 for the gas department of Public Service Gas and Electric Co. The sum is in addition to $23,000,000 previously appropriated for the new *Sewaren, N. J.*, electric generating station and other construction work.

Highways—A bill to increase to $40,000,000 the amount of revenue bonds to be issued by the *Delaware* State Highway Department for the new Delaware River bridge has been introduced in the state House of Representatives. . . . The *Kentucky* State Highway Department has about $25,000,000 on hand for construction contracts during the next fiscal year. . . . Construction of a viaduct over a grade crossing in front of the union station at *St. John, N. B.*, would be financed jointly by the Canadian National and Canadian Pacific railways, the dominion government and the city. . . . The Mississippi State Highway Department, has announced plans for construction of a $1,000,000 bridge across the Yazoo River on U. S. Highway 61, about 10 miles north of *Vicksburg* at a cost of $1,000,000.

Housing—Plans for an extensive housing and slum-clearance project are under way at *Portland, Me.* . . . Contracts will be awarded soon for a city-sponsored housing project on a 200-acre site in the Mattapan section of *Boston, Mass.* . . . *Housing* bills presented to *Connecticut's* general assembly include one asking the state to provide $20,000,000 for multiple units, the state to pay as a subsidy 10 percent of the cost and also property taxes for seven years. . . . Kushin and Katzman and Sherman & Sherman are getting under way with $4,500,000 developments in *Philadelphia, Pa.*

Water and sewers—The new sewerage system at *Terre Haute, Ind.*, to start next year, will include an interceptor sewer, a pumping station a mile south of the city, and a final sewage treatment plant. Estimated cost of operation is placed at $2.64 per citizen, including fixed charges. . . . City Engineer F. E. Hall, of *Greenville, Miss.*, will prepare plans for extension of the sanitary sewage system at an estimated cost of $186,000, and extension of the waterworks system at $351,000. . . . Plans are being prepared for a $100,000 sewer system for *Pendleton, S. C.* . . . *At Buffalo N. Y.*, the Common Council has authorized issuance of bonds for $425,000 to finance extension of lines.

Public construction — A $950,000 bond issue for a new high school is to be voted on at *Olney, Ill.*, March 8 . . . A new school building to cost $296,685 will be built at *Grenada, Miss.* . . . Work will start soon on a $3,000,000, 12-story state office building at *Montgomery, Ala.* . . . Gov. Ralph F. Gates of *Indiana* has proposed a $25,000,000 construction and rehabilitation program for about 25 educational, penal and benevolent institutions, to begin within two years. . . . The Engineers' Club of *St. Louis, Mo.*, is considering the construction of a new home to cost $150,000 for the lot and $350,000 for the building . . . The YMCA at *Memphis, Tenn.*, is planning a $1,000,000 expansion program including additions to its building

Delaware wage claims to be arbitrated

After five weeks of strife which had throttled construction work, Delaware's building trades industry assumed a quieter aspect last week as union plumbers and electricians returned to their jobs under agreements to submit their demands for increased wages to arbitration.

Plumbers as well as steamfitters are to be paid a temporary rate of $1.90 an hour during arbitration. Francis E. B. McCann, executive vice-president of Allied Construction Industries and a member of the arbitration board, said hearings would be held on both cases as soon as evidence is received from employers and unions.

The case of the electricians—who had not worked for contractors since their contract expired Dec. 31—will go to Toledo, Ohio, Feb. 20 for arbitration by representatives of the International Brotherhood of Electrical Workers and the National Association of Electrical Contractors.

Construction to proceed on Clark's Hill Dam

The U. S. District Engineer's office at Savannah has been authorized to proceed with construction of the Clark's Hill multi-purpose flood control, navigation and electric power project on the Savannah River, near Augusta, Ga., under its own direction.

This authorization follows rejection of two previous bids by general contractors which were considered as excessive (*ENR* Jan. 16, vol. p. 82). The present plan is to let contracts for the different portions of the work so that a large number of small contractors can submit bids.

Col. Paschal N. Strong, district engineer, said that by the use of many individual contractors the engineers feel that price fluctuations of materials can be kept in line and the work proceed in an orderly manner. The original estimate of $35,000,000 was based on prewar prices. Army engineers have said the project now is estimated to cost more than $45,000,000.

Two-mile tunnel in Snoqualmie Pass proposed for Cascade Mountain road

Ole Singstad, in report to Washington Toll Bridge Authority, finds no justification for a longer tunnel at lower level

Reconstruction of the present highway that now uses the Snoqualmie Pass through the Cascade Mountains, with a 2.03-mile tunnel under the pass, was recommended to the Washington Toll Bridge Authority by Ole Singstad, New York consulting Engineer, in a report transmitted to the Washington State Legislature on Feb. 4.

In 1945, following strong efforts to revive a 20-year-old project to build a 32-mile tunnel under the Cascade Mountains at El. 1000 for combined highway and railway use, the legislature instructed the Toll Bridge Authority to make a study of both highway and railway connections between eastern and western Washington.

Mr. Singstad's report disposes of the low-level tunnel scheme as unnecessary and impracticable. He also found that combining railway and highway traffic in a single tunnel is not practicable and that two of the three present railway routes through the mountains are reasonably adequate. Therefore, he confined his detailed recommendations to improvements in the highways through the mountains to make them adequate for modern requirements.

Two favorable routes

Two routes offered the greatest possibilities from the viewpoint of traffic requirements and physical conditions. One is along the route followed by State Highway No. 2 through Snoqualmie Pass, and the other is somewhat farther south through Stampede Pass. As heavy snowfalls constitute the most formidable barrier to winter traffic through the Cascade Mountains, Mr. Singstad undertook to determine, with the aid of engineers of the State Highway Department, the elevation above which serious difficulties with snow and slides could be expected. He found that no difficulty with snow will occur that cannot easily be overcome by a well-organized maintenance force below an elevation of 2,000 ft. Hence, he concluded that there was no need to resort to tunneling until beyond the 2,000-ft. elevation.

As his studies indicated that a tunnel 2.54 miles long would be required in Stampede Pass as against a tunnel 2.03 miles long in Snoqualmie Pass, and as there is an existing highway up to and through Snoqualmie Pass, much of which can be used, Mr. Singstad favors that route for the initial undertaking, postponing a decision on the Stampede Pass route until traffic appears to warrant an additional crossing at that point.

Mr. Singstad also recommended reconstruction of the present highway through the mountains as a four-lane road up to the tunnel, and proposes a single two-lane tunnel for the present, with a second tube to be built at a later date. A four-lane approach road can be kept open much more conveniently than a two-lane road, he said.

To make this reconstructed route through the main Cascade range more effective in the development of the state, Mr. Singstad proposed the construction of new highways on both sides of the main range totaling 105.3 miles. One of these roads, which is designed to provide a more direct route from Tacoma to Snoqualmie Pass, has been advocated by Tacoma for years but has been opposed by Seattle because it runs through the watershed from which Seattle draws its supply. Mr. Singstad reported that under poper supervision, such a highway should have no detrimental effect on the Seattle supply.

Estimates of cost

Cost of the two-lane tunnel was set at $21,940,000, and the cost of 30.13 miles of approach highway work was estimated at $11,925,000. The other highway work proposed in the Singstad report would cost about $14,620,000.

Traffic studies made by the State Highway Department, Mr. Singstad said, indicate that tolls on the tunnel ranging from 50c. for a passenger car and driver to $3 for the largest truck would finance a bond issue of $17,000,000, making it necessary for the state to put up an additional $5,000,000 to build the tunnel. As an alternative to this plan, he proposed operating the whole rebuilt highway as a toll facility with higher tolls.

A second tunnel would not have to be built until traffic reached four or five million vehicles per year. Traffic at the opening of the tunnel is estimated at 740,000 vehicles per year.

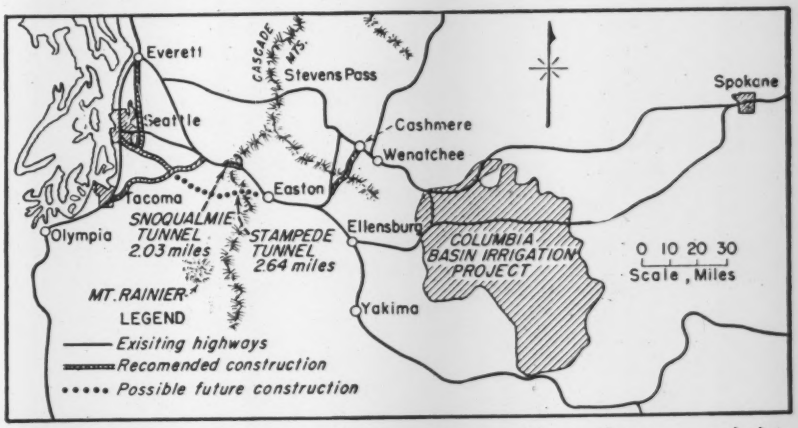
Mr. Singstad's estimate of the income from tolls through the tunnel was based on the assumption that the route over the present summit would be maintained for the use of vehicles not wishing to pay the toll.

Tunnel design features

The tunnel would be 10,676 ft. long, all on tangent except a short curve at the west end. The west portal would be at El. 2,330, and the east portal at El. 2,635, or practically at the summit of the new line. Present summit is at El. 3,004. The prevailing grade in the tunnel would be 3 percent.

A brick-paved roadway 24 ft. wide is proposed for the tunnel, with an elevated 3-ft. wide sidewalk at one side. The headroom is to be 14 ft. 6 in. the tunnel would be lined with reinforced concrete, and the walls and roof would be faced with tile.

The tunnel is to be ventilated throughout, air being supplied from both portal and from a central ventilating shaft 850 ft. deep. Air ducts would be above the roadway.



***Tunnel Through Cascades**—Highway construction work recommended to the legislature of the state of Washington to improve the highway connections between cities in the western part of the state and the rapidly developing regions east of the Cascade Range.*

U.S. consultants survey Ontario Hydro

Following the recent enforced retirement of T. H. Hogg as chairman of the $400,000,000 Hydro-Electric Power Commission of Ontario, the Stone & Webster Engineering Corp. of Boston, Mass., has been engaged to survey the engineering part of the activities of the commission.

The Toronto firm of J. D. Woods and Gordon will study the hydro's general administrative organization and statistical data, and G. T. Clarkson, a Toronto accountant, will advise on the financial problems of the commission.

Premier Drew of Ontario, whose radio-broadcast demand for Dr. Hogg's resignation (*ENR* Feb. 6, vol. p. 185) on charges of "refusal to communicate" essential information precipitated the investigation, said he has "utmost confidence" in the efficiency and loyalty of the officials and staff of the Hydro organization but that the inquiry is needed because of the expansion scheduled to start in the immediate future.

Stone and Webster have been asked to report on power supply both from the short-term and long-term points of view, including the possible use of auxiliary steam plants (as yet unused in Ontario); examine the possibilities of new sources of power; and review the estimated costs for the proposed change-over in the southern Ontario system from its present 25 to 60 cycles.

Mr. Drew also said Ontario is proceeding to complete certain agreements with Quebec for further plans for the joint development of power sites on the Ottawa River, which forms part of the boundary between the two provinces.

The various experts have been asked to make their first reports within five weeks so that this information may be available for consideration at the forthcoming session of the Ontario legislature.

College building plans total millions

Universities and colleges in various parts of the country are planning extensive building programs. Many of these have already been mentioned in these columns. Among others currently being considered are these:

Fred T. Mitchell, president of Mississippi State College at Starkville, has outlined a long-range building program for the institution that would require the expenditure of approximately $3,400,000.

This program includes a $1,000,000 library, a $400,000 to $500,000 engineering building, a $1,000,000 chemistry building and a $900,000 agricultural building.

In addition, the State Building Commission has just allocated over $800,000 to the college for new projects including a $550,000 gymnasium and $175,000 for faculty apartments.

The University of Mississippi at Oxford has been allocated $901,350 by the Mississippi State Building Commission for major construction improvements.

A sub-committee of the board of trustees of Mississippi institutions of higher learning has inspected sites in the Mississippi delta for location of a new $300,000 vocational college for Negroes and soon will make a recommendation to the full board.

University of Missouri budgets millions

The University of Missouri at Columbia, announcing a 2-year budget of nearly $20,000,000, said recently that $2,290,000 will be used for a teaching hospital and nurses' home for use in re-establishing 4-year instruction in medicine at the university.

Other construction items in the budget are: Radio station, $200,000; chemistry department, $450,000; infirmary, $500,000; engineering, $600,000; agricultural engineering, $225,000; botany and plant pathology, $750,000; and school of mines and metallurgy, Rolla, $930,000.

Florida colleges need buildings

The Florida Improvement Commission has indicated that the nearly $14,000,000 allocated for new construction at state-supported colleges is about $9,000,000 short of what the institution heads and the board of control say they need. As of Jan. 15, the cabinet had authorized large expenditures, planned construction at the University of Florida, Florida State College for Women, Florida A. and M. College for Negroes, and the School for the Deaf and Blind.

Work at Ohio Wesleyan

Ohio Wesleyan University at Delaware, Ohio, announced a development program calling for $3,000,000 in construction over the next two years. Included will be nine new buildings, rehabilitation of six others, and general improvements to the campus.

The university already has received gifts totalling more than $1,200,000 to finance the new work.

In Washington State

Both the University of Washington at Seattle, and Washington State College, at Pullman, are proceeding with extensive building programs. Washington State recently received low bids of $3,772,785 for construction of a classroom building and an Institute of Technology building. The University of Washington is receiving bids until March 4 for additions to the Physics Building and Johnson Hall, estimated to cost over $1,200,000.

Institutional building proposed in two states

A $20 million program of construction at Ohio's mental and penal institutions will have top priority in the Ohio Public Welfare Department for the next two years, it has been announced by Director Charles L. Sherwood, who instructed superintendents of the state's 27 such institutions to cooperate in getting the work under contract by next fall.

The last regular session of the legislature appropriated $23 million for new construction and additions and improvements at state institutions, and the money must be under contract by Oct. 18, 1947. Only about $3 million has been placed under contract so far. Plans are drawn, however, to cover most of the remaining $20 million.

Pennsylvania's program

Construction of a 200 bed $3,000,000 medical therapy building at the Philadelphia State Hospital, Byberry, has been ordered in a move to ease overcrowding at the institution and to facilitate the treatment of patients.

Announcing that plans for the building had been completed, Governor James H. Duff of Pennsylvania on Jan. 28 said that he had ordered advertising of bids so that construction could proceed as soon as possible.

Center on mental hospitals

This work will be in addition to the previously-announced $2,000,000 unit at Byberry to house 450 patients in an effort to provide additional accommodations at the badly congested institution.

Meanwhile, Duff gave the go-ahead signal for further construction of new mental units and repair of existing hospitals in the state when he said that the plan to expend $8,000,000 for maximum security prisons would be shelved temporarily and the funds used to expand the state's mental health program.

Threat of dumping surplus equipment concerns distributors, manufacturers

Associated Equipment Distributors worried over return of war-surplus construction machinery from abroad—Elect W. A. Danner as president

The fear that relatively large amounts of government-owned war surplus construction equipment, sold abroad to foreign buyers, may be "dumped" on the U. S. market in direct competition with local production was the center of attention as distributors and manufacturers met at Chicago last week.

Occasion was the 28th annual convention of the Associated Equipment Distributtors, during which the more than 1,800 delegates watched the seating of William A. Danner, of Hyde Park, Mass., as president, succeeding F. B. McBath, of Portland, Ore., in the chair.

The problem of war surplus construction machinery and its disposal has been a major one for the AED for several years, but a recent State Department order (ELC Regulation 8, Order 6), permitting the return to this country of a broad category of some 79 items of surplus materials—including construction equipment—sold abroad to private buyers, brought the matter to a head.

F. Gerald Moyer, field representative for the AED committee on disposal of government surplus, told members that the disposal of construction machinery had assumed international proportions.

Lack of shipping space, however, will probably prevent a good proportion of this equipment from entering the domestic market until early in 1948, he said. "From then on," he added, "it's impact on the equipment industry may be felt for a long time, creating uncertainty among manufacturers with corresponding reduction in production schedules."

As to the current situation within the U. S., Mr. Moyer reported that $105,000,000 worth of surplus construction, farm and mining machinery is now being offered for sale, plus $45,000,000 worth of repair parts.

Pointing up the danger of entry of equipment from abroad, he said that in Hawaii there is now reported to be a $23,000,000 pool of machinery up for sale—with a potential $75,000,000 worth of additional equipment to follow.

Revised order expected

It was reported to the convention that as a result of protests by individual manufacturers, a revised order is under consideration by the State Department. It is anticipated that the revised order will drop certain items on which American production is close to demand, and will establish a final date beyond which no items can be shipped to this country.

As a protection to buyers who have made purchases since issuance of the original order, it is believed that the revised order will set a "reasonable" time limit within which items struck off the list can be shipped from foreign ports.

William A. Danner
Heads Associated Equipment Distributors

Although no accurate prediction can be made at this time, indications are that power shovels, crawler tractors and motor graders will remain on the revised list of items that can be admitted until the later date, when return of all surplus equipment is expected to be stopped.

F. O. Salditt, vice-president of Harnischfeger Corp., Milwaukee, Wis. acknowledged that prompt return of a limited selection of urgently needed items of construction equipment from overseas would be beneficial in supplying certain customer needs, but warned that any appreciable delay will increase confusion among the equipment manufacturers. This will lead to cut-backs in production schedules and delay deliveries.

Government must realize that industry can render as valuable assistance in solving this peacetime problem of surplus equipment disposal as it did in increasing its production during the war, declared Mr. Salditt. Moreover, inventories should be made of surplus equipment overseas to determine the amount reuseable, while regularly appointed dealers should be authorized, both here and abroad, for its proper disposal, he said.

Construction forecast

Current trends and 1947 forecasts for construction were presented to the convention by H. E. Foreman, managing director of the AGC, and Charles M. Upham, engineer-director of the ARBA.

"The immediate goal of the AGC," said Mr. Foreman, "is stabilization of construction costs, concurrent with the contractor's ability to make a firm bid on a competitive basis as current uncertainties are removed."

The use of day labor for public works construction appears to be on the decrease, said he, and a greater amount of highway maintenance is being done by contract instead of by state-owned equipment and hired labor. In industrial fields, however, there is a tendency for unions employed by the factory to demand that construction be performed by men from that union rather than having the work done by contract.

Mr. Upham predicted an increasing volume of highway construction for several years ahead, with $1 billion of new work by state highway departments during 1947. Despite engineer shortages in some states, he expressed a belief that federal-aid work could be programmed in time to obligate the two $500,000,000 congressional appropriations, now available.

Resolutions adopted

Resolutions adopted at the closing session urged the elimination by manufacturers of the escalator clause on all acknowledged equipment orders of less than 120 days delivery regardless of the actual shipping date, and pledged support of the association to the various apprentice training programs.

Within 60 to 90 days the AED hopes to publish a 1947 edition of its Compilation of Rental Rates for Construction Equipment, to be used for informational purposes only.

New officers

William A. Danner of Parker, Danner Co., Hyde Park, Mass., was elected president of the association, succeeding F. B. McBath, of Portland, Ore. A. F. Garlinghouse was named executive vice president, and Eldon M. Farnum, St. Louis, Mo. was elected treasurer, succeeding W. W. Bucher, New York, N. Y. Other newly elected vice presidents are H. L. Burleson, Dallas, Tex. and V. J. Sheridan, Ontario, Canada. C. F. Halladay, Sioux Falls, S. D. was reelected vice president.

Panama Canal studies under way at Harvard

Harvard University has entered into a contract with the Panama Canal to make laboratory studies in connection with proposed new facilities involving new locations and types of waterways, soil and rock tests, consideration of additional locks, and the effect of earthquake and volcanic activity (*ENR* Jan. 30th, vol. p. 175).

Arthur Casagrande, professor of soil mechanics and foundation engineering; H. M. Westergaard, professor of civil engineering; and L. Don Leet, seismologist, are now actively engaged in these studies.

Dr. Casagrande said that ordinary methods of testing samples of soil and rock from a proposed canal cut are now of little value since they show the strength characteristics of material only under static conditions.

New testing chambers for triaxial compression tests are now under design which will subject samples to dynamic types of forces which result from explosions of present day ammunition. A sample of soil or rock is placed in a lucite cylinder with substantial metal ends. Above the sample is a proving ring attached to a piston which exerts a load on the sample, the load being measured electronically by strain gauges mounted on the ring. The amount of deformation is also measured electronically, by strain gauges on a cantilever beam mounted on the piston. The pressure inside the chamber can be raised to simulate conditions at earth depths from which samples are taken.

Adm. Ben Moreell to head Jones & Laughlin Steel

Admiral Ben Moreell, president of the Turner Construction Co. of New York City, has been elected chairman of the board of directors, chairman of the executive committee, and president of the Jones & Laughlin Steel Corp., Pittsburgh, Pa., succeeding H. E. Lewis, who retired from those offices on account of his health. Moreell will begin active duties on March 17.

Admiral Moreell, wartime chief of the Bureau of Yards and Docks, retired from the Navy last September to become president of the Turner Construction Co. (*ENR* Sept. 26, '46, vol. p. 399). He will continue as president of that company until June 1, and thereafter will remain a director. His last naval assignment was as Chief of the Materials Division in the Office of the Assistant Secretary of the Navy.

MAJOR MEETINGS

American Concrete Pipe Association, annual national convention, Statler Hotel, St. Louis, Mo., Feb. 23-25.

American Concrete Institute, 43rd annual convention, Netherlands Plaza Hotel, Cincinnati, Ohio, Feb. 24-26.

National Council for Stream Improvement, annual meeting, Waldorf Astoria Hotel, New York, N. Y., Feb. 24-26.

American Society for Testing Materials, Committee Week, Benjamin Franklin Hotel, Philadelphia, Pa., Feb. 24-28.

Association of Highway Officials of the North Atlantic States, 23rd annual meeting Hotel Traymore, Atlantic City, N. J., Feb. 26-28.

National Sand and Gravel Association, 31st annual convention, Biltmore Hotel, Los Angeles, Calif., March 3-7.

Mississippi Valley Conference of State Highway Departments, 38th annual meeting, Edgewater Beach Hotel, Chicago, Ill. Mar. 14-15.

American Railway Engineering Assn., Palmer House, Chicago, Ill., Mar. 18-19.

Engineers-in-training organize in New York

At a meeting in New York City Jan. 30, a group of 34 engineers-in-training adopted a resolution to form an organization to be known as "The New York State Society of Engineers-in-Training" and to accept the proffered sponsorship of the New York State Society of Professional Engineers.

A steering committee of fourteen volunteers was appointed to study a proposed constitution, draw up a set of bylaws, and select nominees for the first officers.

The meeting was sponsored by the New York State Society of Professional Engineers through its Committee on Engineers-in-Training, consisting of John C. Riedel, Arthur V. Sheridan, D. B. Steinman, and Frederick H. Zurmuhlen. This committee obtained the initial authorization of the plan to certify engineers-in-training in 1941, and planned the present organization.

The NSPE and state group are to be parallel, with state societies and county chapters, and are to function on a basis of mutual interest and cooperation. The new society will completely control its own activities. Its executive board will include some professional engineers, to be designated by the older State Society, to serve in guidance and advice.

Among the objectives are:

The promotion of the status of the Engineer-in-Training;

The dissemination to both the public and the profession of information relevant to the engineer-in-training, and the establishment of ethical codes of conduct.

Two states announce anti-pollution work

Plans announced in Massachusetts and Indiana for extensive anti-stream pollution efforts

A new proposal for ending pollution of the Merrimack River and plans for an extensive sewage disposal project have been submitted to the Massachusetts legislature by the Merrimack River Joint Sewerage Board, after a year-long study.

Six treatment plants—at Tewksbury, Lawrence, Haverhill, Amesbury, Newbury and Salisbury—were recommended as a result of the study.

Thomas R. Camp, Boston consulting engineer, made the investigation for the board. As a result of his survey, which included consideration of anti-pollution efforts in the valley as far back as 1887, the 6-plant project, at an estimated cost of $27,600,000, was recommended to reduce to safe levels the bacteria count in the river and also to remove a major part of the pollution.

Under a 40-year plan of financing suggested in Mr. Camp's report, manufacturing establishments discharging wastes into the river would pay about 58 percent of the annual cost, and the 18 municipalities would bear the other 42 percent.

Communities that would be involved in the project are Amesbury, Andover, Billerica, Chelmsford, Dracut, Groveland, Haverhill, Lawrence, Lowell, Merrimac, Methuen, Newburyport, North Andover, Salisbury, Tewksbury, Tyngsboro and West Newbury.

Camp reported that about 77.5 percent of the organic pollution of the river, on an average, was caused by manufacturing plants.

An additional factor in reducing operating costs is the fact that methane gas, which can be burned to produce heat and power, would be produced during the sewage treatment process. At three of the projected plants, electric power need not be bought from outside sources, since the methane could be used to produce enough. And at the other three, methane as a heat source would reduce operating costs.

Indiana's anti-pollution plans

Final plans for pollution control projects in 21 cities and towns have been approved by the Indiana Stream Pollution Control Board, B. A. Poole, Board technical secretary has announced.

The 21 projects will cost an estimated $8,000,000.

Included in the list is the $3,000,000 Elkhart sewer system and treatment plant on which final plans for certain sewers were given approval.

OBITUARY

Benton H. Swearingen, 49, assistant to the chief maintenance engineer of the Ohio Highway Department, Columbus, and an employe of the department for 23 years, died Jan. 28. He was graduated from the college of engineering at Ohio State University in 1922.

Francis G. Somner, 83, one time district engineer for the California division of highways, died Feb. 5 in San Francisco. A native of New Zealand, Somner was employed for a time with the Southern Pacific Railroad in California before joining the division of highways in 1912. He retired in 1932.

Roy L. May, 58, chief engineer and secretary of the Tulare Lake Basin Water Storage District, Calif., died Jan. 19 at Hanford, Calif. He attended Polytechnic College of Engineering, Oakland, Calif. After seven years with the engineering staff of the Northwestern Pacific Railroad, he became assistant engineer for the Kings County, Calif., highway commission, and served as county surveyor from 1917 to 1925. He was secretary of the Southern San Joaquin Valley Flood Control Association and had been identified with the Pine Flat and Central Valley projects.

Herbert Appleton Gould, 65, former engineer with the U. S. government. died Feb. 3 in Jackson, Ala.

Roy Perry Miles, a member of the civil engineering firm of Cobb, Beasley & Miles, Springfield, Mass., died Feb. 6, in that city.

Frank A. Buttrick, 69, Andover, Mass., contractor, died Feb. 7. He became president of the E. W. Pitman Construction Co. in 1900 and constructed buildings for Phillips Exeter and Phillips Andover academies.

Egbert J. Ragon, 70, former president of the Peoria and Pekin Union Railway Co., died Feb. 4. He majored in civil engineering in the University of Missouri and began his career with the Lorimer-Gallagher Co. Becoming associated as a civil engineer with the Illinois Central, he served until 1921 when he joined the Peoria and Pekin Union.

Frank E. Herdman, 81, construction engineer for many years in the Chicago suburban area, died Jan. 28. Previous to 1938 he was active in the construction of highways and bridges in Cook County under public contract. He was graduated from the college of engineering, University of Illinois, in 1884 and obtained his professional engineering degree there in 1889.

Edward Haupt, 77, Evanston, Ill.. a civil engineer who was one of the founders and for many years president of the Strobel Construction Co., contractors for bridges and steel buildings in the Chicago and the mid-west, died Feb. 5. He had been president of the Chicago Engineers Club and of the Building Construction Employers' Association.

George S. Clark, 78, Alabama State Highway Department civil engineer, died at St. Clair Springs, Ala.. on Jan. 28. A graduate of Alabama Polytechnic Institute, he was a former professor at the University of the South, Sewanee, Tenn.

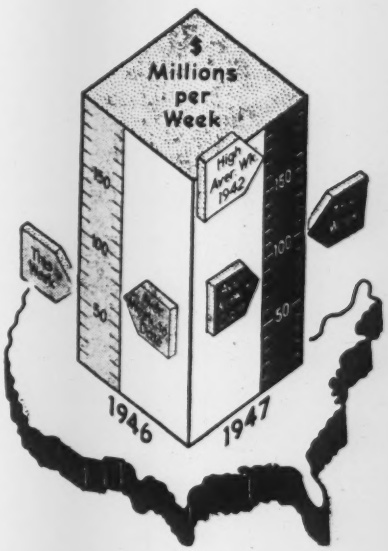
Raoul C. Gautier, a supervisor of construction, Foreign Buildings Operations, U. S. State Department. died in Washington, Jan. 20. Born in Paris, France, and a graduate of the Ecole des Arts et Metiers, his early work was with the Hennebique Co. of France on the development of reinforced concrete design. In 1914 he came to the United States and was associated with Truscon Steel Co., and Thompson and Binger, and was for many years a consulting engineer in New York City. After the earthquake in Managua, Nicaragua, in the early thirties, as a member of Dambach & Gautier he built most of the modern monumental buildings there, including the National Palace and the U. S. Legation. Subsequently he was engaged in the rehabilitation of railroads for the Brazilian government.

Robert T. Leipold, 70, a bridge engineer who helped the U. S. Navy design a 40,000 ton floating drydock to repair big ships near battle areas, died Feb. 9 in Washington, D. C. He took his engineering degree at Princeton in 1897. He played a major role in the design of the cantilever arch of the Hell Gate bridge over the East River in New York. For the last 14 years he had been an engineer for the American Bridge Co.

Walter F. Hendrich, 60, president of the W. F. Hendrich Co., Inc., Buffalo, N. Y., contracting firm, died Feb. 8.

For Men and Jobs see page 172; Elections and Activities page 182; and Engineering School News page 188.

CONSTRUCTION ACTIVITY



As Reported this week to ...
Engineering News-Record

CONTRACT VOLUME

Continental U. S. Only
(Thousands of Dollars)

	Week of Feb. 20 1947	Cumulative 1947 (8 wks.)	Cumulative 1946 (8 wks.)
Federal	$11,027	$67,595	$55,196
State & Mun.	15,714	164,821	108,106
Total Public.	$26,741	$232,416	$163,302
Total Private	71,722	463,341	336,124
U. S. Total..	$98,463	$695,757	$499,426

WHERE CONSTRUCTION ACTIVITY ORIGINATED THIS WEEK

Dollar Volume (Thousands)

Type of Work	This Week	Cumulative 1947 (8 wks.)	Cumulative 1946 (8 wks.)
Waterworks	$444	$17,125	$8,389
Sewerage	361	13,944	4,540
Bridges	2,811	18,843	15,673
Highways	4,905	63,039	56,384
Earthwork, Waterways	9,852	19,876	31,312
Buildings, Public.	5,754	68,391	36,755
Industrial	11,101	124,087	142,147
Commercial ...	40,524	292,585	174,250
Unclassified	22,711	77,862	30,026

NOTE: Minimum size projects included are: Waterworks and waterway projects, $22,500; other public works, $40,000; industrial buildings, $55,000; other buildings, $205,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1947 (8 wks.)	Cumulative 1946 (8 wks.)
NON-FEDERAL		$136,287
Corporate Securities	Current	62,704
State and Municipal	figures	73,583
FEDERAL	not	158,320
Total Capital.....	available	294,607

ENR INDEX NUMBERS

Index Base = 100		1913	1926
Construction Cost..	Feb. '47	390.76	187.84
Building Cost	Feb. '47	297.38	160.75
Volume	Jan. '47	195	86

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Labor—always the backbone of construction, but the key to its success in 1947. Too few of him, either in numbers or skills, will make labor the drag on accomplishment this year that materials supply was last.

SURVEY AND FORECAST

1946-1947

IN ONE RESPECT our first full postwar year was reminiscent of our first year in the war. Both in 1946 and in 1942 there were so many things to do, so many demands to be met and difficulties to be overcome that our daily accomplishments seemed always to be overshadowed by failures.

Tripping over our own feet, bungling a job here and there, never quite attaining a goal because it was always changing and enlarging, we lost the perspective of advance. Yet, looking back at 1942, there was reason for it to be characterized as a time of high accomplishment.

So it is now with 1946. Despite strikes that lost an estimated one hundred million man-days of production, in the face of materials shortages, rising costs and worrisome governmental controls, the year, constructionwise, was one of substantial and noteworthy performance. Some records were established, and total contracts for new construction reached $10 billion, not far below the biggest of prewar annual volumes. The conversion from war to peace produced headaches, but there were noteworthy results notwithstanding.

Mirror and Crystal Ball

WHAT 1946 PRODUCED and what 1947 promises form the subject matter of this issue, and each may be sketched broadly as an introduction. Looking first in the mirror, 1946 is seen to have been dominated by a federally managed objective to provide housing for war veterans. Housing was the sun, all else satellites. Probably more than half of the energy of the construction industry was applied directly to housing, and no part of the remainder was free of its influence. Not only was the bulk of materials and large amounts of equipment reserved for housing, and thus not available for other types of construction, but restrictions and controls, progressively more stringent and usually unpredictable, were applied to commercial and industrial building and public work.

Under the circumstances, housing should have boomed. Whether it did or not depends upon the yardstick used. Some 470,000 conventional houses were completed, about twice as many as the year previous, but only half the record year and only two-thirds of the goal set for 1946. In the supplemental program for 250,000 prefabricated houses a production of only 40,000 leaves no basis for quibbling over success or failure. Shortage of materials was the basic deterrent to a greater housing volume, while the prefab failure can, in addition be attributed to the mistaken concept that the wartime practice of creating entirely new industries in a matter of months could be repeated in peacetime.

Despite the emphasis on housing and attempts at artificial restriction, contracts were awarded for large volumes of other types of construction. Without going into detail, which is supplied elsewhere in this issue, physical volume was up about 100 percent over 1945, and dollar volume even more. Lest such increases should excite too great satisfaction, however, it should be pointed out that they represent contracts awarded, not work completed. It is a sobering fact that 1946 is also noted for the record volume of construction that it bequeathed for execution to the year that is to follow it.

All of this contract activity, however, coupled with materials shortages, had its effect on costs, *ENR's* indexes advancing about 20 percent. Common labor rates went up 16.5 percent and skilled rates 11 percent. Materials advances in quoted prices ranged from 16 percent for brick to 40 percent for pine lumber. Black-market prices were unknown amounts higher.

What of the Future?

A CRYSTAL BALL is never as clear as a mirror, but a pattern for 1947 still may be made out. Except for labor, all elements are in fair focus. There could be a labor shortage, if not of hands certainly of skills, should construction volume increase ap-

preciably. Strikes and work stoppages are less to be feared than low worker-productivity.

Although some lumber and plumbing items will continue to cause difficulty, supplies generally are approaching adequacy, so that materials shortages should not be the No. 1 problem this year as they were last year. Prices, after a long sustained rise, show a tendency to level off, and final construction costs should be lowered through elimination of black-market prices and delays from non-delivery of materials. Although housing will continue to occupy the spotlight, tempering of restrictions on non-housing construction will provide a more balanced construction picture.

Stability of costs, even at present high levels, continuing improvement in the supply of materials, and a fair, if somewhat doubtful, prospect for an adequate labor force, provide a basis of hope for substantial construction achievement in 1947. The *ENR* estimate is $12 billion, up about 20 percent over 1946.

Materials Demand Exceeds Supply

In 1946, the origin of all troubles seemed to center in shortages of construction materials. Probably as great a volume of materials was produced as could have been used effectively, but it was not enough to exert any downward pressure on prices, and far from sufficient to satisfy demand. Practically everything was in short supply at the beginning of the year, but by the end production had increased in all items, phenomenally in the case of some, such as brick, clay tile and cast-iron soil pipe.

In-so-far as housing was concerned, lumber and sheet steel shortages were the most serious and persistent. Nails and reinforcing bars, too, were continuously scarce, largely as a result of errors in judgment and tardiness in policy execution of the Office of Price Administration; under the prices permitted, producers found it more profitable to put their steel into other items. At the year end most maladjustments from controls were disappearing, and prospects for increased production all along the line are good, except for hardwood flooring, plywood and certain plumbing supplies.

Equipment Just Squeezed By

Principally because of the shortage of materials, construction was able to squeeze by last year with the equipment it could patch up or scrape together. Some new machines went to contractors, and some war surplus units reached the construction front via governmental agencies, but the total would have been far from adequate if jobs had really been rolling. Currently, pumps are said to be reasonably available, compressors can be delivered in three months and mixers in a little longer; pavers are said to be in ample supply. Most other equipment, except tractors, shovels and heavy earthmoving machines, should also be available by mid-1947. Shovel manufacturers have been concentrating on small models; the 1½ and 2½ cu. yd. units are two years behind in production. The situation with respect to new models and designs of construction machines is presented in a special article in this issue.

Labor Barrel About Empty

Contractors had little difficulty securing labor during most of 1946, a more pressing problem being to keep their forces continuously busy in the face of uneven materials deliveries. As the year wore on, however, evidence accumulated that the bottom of the labor-supply barrel might soon be in sight. On-site labor, totaling about 1.2 millions in January, reached 2.3 millions in August. Further increase in construction volume could readily create shortages of both skilled and unskilled workmen.

Tackling the problem of skilled-labor supply, both the federal government, through the War Manpower Commission, and various of the craft labor unions have doubled the number of apprentice-training programs. Even so, the 90,000 men in training are only about one-third of the number established by the General Committee on Apprenticeship for the Construction Industry as necessary to supply 40,000 new journeymen annually and maintain a labor force of 2,000,000 craftsmen.

Construction labor strikes in 1946 were inconsequential compared with those suffered generally by the manufacturing industries. Few jurisdictional disputes occurred, and toward the year end a constructive move was made by the Metal Trades Department, AFL, in adopting machinery to settle them without resort to strikes. The secondary boycott is the worst remaining bad spot in the jurisdictional strike picture, and there is some hope that Congress may deal itself a hand in this cutthroat game during the year.

With free collective bargaining again in force, and a desire on the part of workmen to stay on the job and earn the highest wage rates in history, widespread strikes should not be a major problem in 1947. Because of the high wage rates, over-

More rental housing in large scale multiple-unit buildings such as these of the Brownsville project of the New York City Housing Authority was what the 1946 housing program needed, and what 1947 plans contemplate.

time demands should also decline. Indeed, new agreements in New York City made elimination of overtime a condition of granting increased rates.

Housing Through Federal Controls

As stated earlier, the spotlight in 1946 was focused on the problem of constructing houses in unprecedented numbers to accommodate returning servicemen and their families. Government intervention to find a solution met with some success, but the demand for dwellings was always greater than the supply. Moreover, growing opposition to federal controls, some selfish, some representing an honest difference of opinion, caused their virtual abandonment as the year ended. This housing history is worth recording.

In January, Wilson W. Wyatt, former mayor of Louisville, Ky., went to Washington as housing expediter and administrator of the National Housing Agency, charged with recommending and executing a plan for alleviating the housing shortage. The proposed plan led to the Veterans' Emergency Housing Act, passed by Congress on May 22, giving the expediter broad controls over building materials prices and exports, providing subsidies to spur production of bottleneck materials and increasing the government's authority to insure home loans through private capital.

A two-year program visualizing construction of at least 2,700,000 units was put under way. For 1946, the goal was set at 900,000 permanent houses, 200,000 temporary units, 50,000 converted units and 50,000 trailers, with heavy reliance placed on factory-built houses. These figures were said to refer to "starts" rather than completions. At the year's end, except for the failure of factory-built houses to meet the quota, the goal for starts came close to being met, but completions lagged, with fewer than 500,000 permanent homes readied for occupancy.

Material shortages were the chief bottleneck. To alleviate these, Mr. Wyatt resorted to his priority and allocation powers and premium payments. Competition for materials from non-residential construction was decreased by Veterans' Housing Program Order 1, issued March 26, requiring special authorization for most other types of building. When non-residential building still continued high, VHP-1 was tightened at the end of May and again on Sept. 1, finally limiting Civilian Production Administration authorizations to a weekly rate not exceeding $35,000,000. And on Aug. 6 a

moratorium was declared on letting of contracts for federal construction. A priority system was established for channeling materials to houses for veterans, giving holders of an HH priority first call for the delivery of building products and extending these ratings beyond the distributor to the producer.

Too Little Rental Housing

THUS SPURRED ON, residential construction put in place rose steadily to one of the highest levels in 20 years at the end of October. Unfortunately, insufficient rental housing was produced, and many veterans preferred to rent rather than buy. To provide more rental units Mr. Wyatt urged passage of the Senate-approved, House-defeated Wagner-Ellender-Taft bill, but Congress would not re-introduce the measure.

Price and rent control were probably the principal deterrents to a greater volume of rental building. Houses were limited to what could be sold for less than $10,000 or rented for less than $60. Thus the builder was pledged to sell or rent at a predetermined price although the cost of labor and materials was constantly rising.

With traffic jams forming during rush hours on the 10-year-old San Francisco-Oakland Bridge, studies are under way on sites and types for another vehicular crossing between these West Coast cities.

Removal of Controls Sets New Stage

FINALLY, a series of events that began with President Truman's Nov. 9 order removing price controls from the construction industry led to Wyatt's resignation on Dec. 5. On Dec. 14, the President announced the removal of remaining controls, except on rentals and non-residential construction. An Office of Temporary Controls was set up.

For 1947, it was promised to push rental housing, to continue premium payments to manufacturers of materials, to extend the guaranteed market provisions for factory-built homes, to increase RFC loans to prefabricators and building material manufacturers, and to broaden the use of insured mortgage financing. Rent ceilings were revised to permit an average of $80 per month per unit. The principal limiting provision is that dwellings shall not exceed 1,500 sq. ft. in area.

Housing By Institutional Capital

Perhaps the most significant trend in housing is the development and operation of large-scale residential communities by savings-and-loan associations, savings banks and insurance companies. Current rental housing developments of this type now total $325,000,000 throughout the country. Behind this move is the successful example set by the Metropolitan Life Insurance Co. and other pioneers in this field. Legislative encouragement for this type of institutional financing was given by Louisiana and Missouri, which joined Illinois, Minnesota, Massachusetts, Pennsylvania, New York, New Jersey, California, Virginia, Connecticut and Wisconsin as states in which legislative acts had been in force previously.

Research Labs and Hospitals

NOTWITHSTANDING government efforts to channel building materials to veterans' housing, non-residential building construction continued at a high level. Many types were represented, and two—research laboratories and hospitals—were notable, particularly in exhibiting the advantages of standardizing on an efficient, economical module, which is repeatedly used throughout the structure.

This is an extension of the principle of dimensional coordination as applied to building materi-

Bank protection of Mississippi River is a continuous operation of the Corps of Engineers. Here articulated concrete revetment is being placed on upper bank (foreground) and underwater from barge beyond.

als, which has long been sponsored by the American Standards Association Project A62 as a major means of achieving economy and simplification. Whereas, in the case of the laboratories, modules vary from about 6 ft. up, the module for building products is fixed at 4 in. A large variety of products now conform, and the campaign to include the remainder continues.

To expedite the Veterans Administration's $800,000,000 hospital construction program, design criteria have been developed for various sizes of general medical and surgical hospitals, tuberculosis hospitals and neuropsychiatric facilities (*ENR* Nov. 14, 1946, vol. p. 662). This was deemed desirable because, of the 74 hospitals appropriated for, 67 have been turned over to the Corps of Engineers, which in turn has contracted with private architect-engineers for preparation of plans and specifications. Along similar lines, the Public Buildings Administration has prepared manuals for the guidance of their architects and engineers and those with whom they contract.

In addition to the VA facilities, there are indications that during the next few years a large program of civilian hospital construction will be carried out. The Hospital Survey and Construction Act (Public Law 725) authorizes, under the administration of the U. S. Public Health Service, the appropriation of $3,000,000 for statewide hospital surveys and for planning of construction programs, and $75,000,000 annually for five years for actual construction.

Building Code Problems

SOME of the high cost of construction in urban areas, particularly of dwellings, is attributed to unnecessary, restrictive provisions in city building codes. Under this accusation, many cities throughout the nation restudied their codes with a view toward removing these restrictions or to abandoning a specification-type code in favor of a more flexible, performance-standards type. To facilitate this trend, the Building Officials Conference of America hastened work on a model national building code, issuing the chapter on prefabricated construction somewhat prematurely so as to be of aid in the emergency housing program. Formation of a new organization—Building Officials Foundation—is being pushed by BOCA to implement adoption of the national code and other objectives that will be of great benefit to code administrators and the general public.

Building Design Advances

IN ADDITION to previously mentioned progress, notable headway was also made in 1946 toward betterment of building design along other lines. Affecting structural steel, the specification of the American Institute of Steel Construction was modified to incorporate welding standards, revisions in allowable stresses and recognition of the theory of limit design. The American Iron and Steel Institute issued the first comprehensive design specification for light-gage steel to promote design of structural members of this material by rational principles.

With respect to concrete, the trend toward use of thin, precast structural members appears to be accelerating, with contractors adopting this type of construction endeavoring to develop mass-production techniques. Air-entrained concrete, which was first introduced for highway construction because of the improvement in resistance to freezing and thawing, is being used in ever greater quantities for buildings because of improved workability, ease in handling and placing, and freedom from segregation and water gain. Greater use is also being made of exposed, painted ceilings of concrete in residential construction, thus eliminating plaster.

Lessons learned from wartime experiences in large-scale construction of timber structures are serving to improve their design. Because of the haste in which many of these buildings were designed and erected, there were bound to be some failures, and it is from these that the profession can learn best how to use timber—if those in position to examine the failures report their conclusions promptly and fully.

Much Bridge Work Contracted

ALTHOUGH it seems incredible in view of the universally reported shortages of bridge-building materials, contracts totaling $126,580,000 were awarded for highway bridge construction last year, plus over $2,000,000 for railroad bridges.

Considerable activity prevailed in the field of express highway bridge construction, and noticeable improvements were made in the architectural treatment of these structures. Roadway curbs are being widened and handrails are becoming more streamline. The multitude of low-cost bridges needed for the farm-to-market road programs gave impetus to the development of economical designs in this field. Increasing numbers of bridges on the primary highway systems are being designed for H20—S16 live load instead of the old H15 or H20 loading, particularly on routes included in the National System of Interstate Highways.

Some Outstanding Bridges

DESPITE the large dollar volume of contracts, there were few really outstanding bridges built in this country during 1946. The all-aluminum deck-girder railway span erected near Massena, N. Y., was significant, however, in that it affords a full-scale comparison between structural steel and aluminum alloy for bridge construction. Other aluminum alloy bridges are reported to be in the design stage.

Another bridge of 1946 which deviated considerably from usual practice is the semi-permanent railway-highway bridge now under construction at the Garrison damsite in North Dakota. Carrying an all-steel deck on steel girders, this 1,350-ft. long structure will be supported on 24-in. dia. tubular steel piles, 100 ft. long, each driven to a 150-ton resistance. For maximum salvage, all field connections, except main girder splices, are bolted with automatic locking nuts.

On what is probably the largest current bridge job, a highway crossing of the Mississippi at Memphis, pier sinking by open dredging of the sticky mud was an economical and time-saving feature of the construction. Piers in the main channel were put under air so as to clean them out in the dry, but the approach piers were sunk full depth as open caissons and sealed with tremie concrete without unwatering.

Roadbuilding Large But Inadequate

NEW HIGHWAY CONSTRUCTION put under contract in 1946 rose to prewar levels, but the total was far short of what should have been done to make our highways reasonably adequate for current needs.

Expenditures to maintain the highway system rose to unprecedented figures, due in large part to deferment of replacement and rehabilitation operations during the war. Present indications are that maintenance expenditures will continue at a high level for some years and may rise considerably before they decline as a result of the replacement of worn out pavements.

The year 1946 was the first full year of work under the Federal-Aid Highway Act of 1944, which for the first time authorized the allocation of federal-aid funds to work on arterial routes through cities and on secondary roads. Good progress was made on the latter program, but much less was accomplished on the more difficult task of building new routes to speed the flow of traffic into and through cities along state highway routes. Such progress as was made was on some of the more ambitious projects that were already in the planning stage when the 1944 act became effective. Nevertheless, much groundwork for cooperation between state highway departments and city public-works departments on this program was laid during 1946, which should soon show concrete results.

Freeways and Superhighways

AMONG THE FACILITIES for speeding the movement of traffic in and out of metropolitan areas that are under construction are the Bayshore Freeway at San Francisco, the East Shore Freeway at Oakland, three additional freeways at Los Angeles, the Central Boulevard-Expressway at Dallas, the Calumet and Tri-State superhighways at Chicago, the John C. Lodge and Edsel Ford expressways at Detroit, the Penn-Lincoln Parkway East at Pittsburgh, the Willow-Newburg Freeway at Cleveland, the Brooklyn-Battery Vehicle Tunnel and the Brooklyn-Queens Connecting Highway at New York.

Starts also have been made on some proposed superhighways, notably New York State's projected 468-mile system of "thruways" and New

Jersey's Route 100, a "dual-dual" highway through the congested northeastern part of that state. Work also is well under way on the Maine Turnpike, a controlled-access toll highway; and in Connecticut construction has been resumed on the Wilbur Cross Highway, which with the Merritt Parkway will give a controlled-access highway diagonally across the state along the most direct route between New York and Boston. Grading of the first section of a superhighway between Houston and Port Arthur, Texas, is nearing completion and grading for the second section will start this year.

City Traffic in the Spotlight

GROWING TRAFFIC CONGESTION on city streets as well as on the highways leading into urban centers served to turn the spotlight on the whole problem of city traffic and parking. Most proposals center around greatly increased facilities for off-street parking, yet most of the plans put forward for such parking cost so much as to make financing difficult. A commission set up to study and report on a traffic solution for New York City outlined a program estimated to cost $132,000,000, which included immediate construction of six parking garages with a capacity of about 10,000 cars, in addition to parking facilities for 2,000 cars in connection with a privately owned sport arena, and the ultimate construction of thirteen additional garages. Construction of a 740-car garage under a wide section of Washington Blvd. at Detroit is expected to get under way about July of this year.

Big Airport Program Started

START of the one billion dollar airport construction program approved by Congress last year will be made about April, 1947. The law authorized the appropriation of $500,000,000 of federal aid over a 7-year period, and enough money has been appropriated to permit about $70,000,000 of actual construction. At an early date the CAA will request Congress to provide a large new appropriation for the fiscal year 1948, which begins July 1, for other new construction projects. Revised, simplified regulations worked out to administer the program are explained elsewhere in this issue.

New Construction Techniques

DEEP CONSOLIDATION of earth has been the recurrent problem of engineering construction in the past year. Consolidation of subsurface silt by installation of vertical columns of sand as drains to expedite settlement is being used successfully on

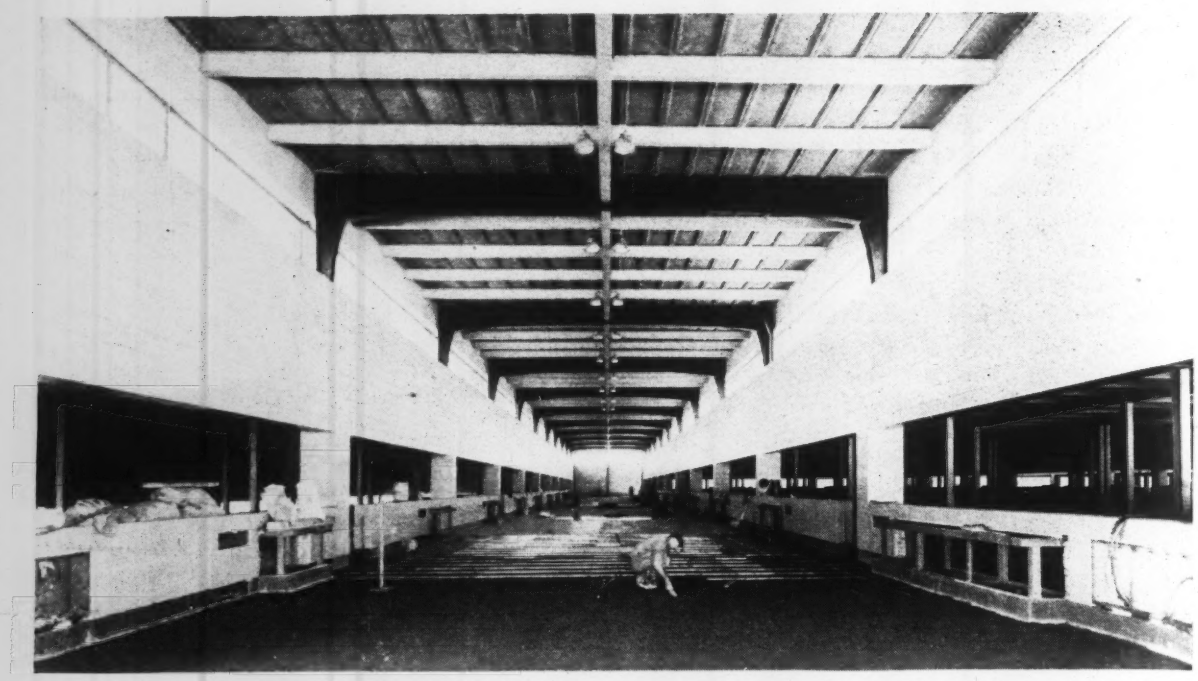
McLaughlin Air Service Photo

Reconstructed section of U. S. Route 1 near Newark Airport, which New Jersey has converted into a "dual-dual" highway of four separated roadways of two lanes each. A much larger dual-dual job is being done on nearby Route 100.

work in California, and is proposed for rehabilitation of sinking La Guardia Field in New York. Means of consolidating existing soil in place under proposed levee locations is also sought; experiments with deep vibration, possibly to as much as 100 ft., were delayed by the federal economy order, but now are definitely contemplated.

A vibratory machine on rubber tires, said to consolidate to a depth of 10 ft., as a base for surfacing, will soon come out of the experimental stage into production. Engineers and manufacturers are experimenting with longer, smaller "feet" on rollers and with heavier wobble units for rubber-tired compaction of road and airfield bases.

Piles continue to increase in length and load capacity. Precast concrete piles 24 in. square and up to 125 ft. long, as well as pipe piles and H-piles to 200 ft. have been driven. In Chicago, 60-ton



Chicago's South District filtration plant, with designed capacity of 320 mgd., soon will begin operation of 40 of its 80 filters. In partial operation since 1945, the plant is now about 90 percent completed.

building loads were permitted on end bearing piles.

In Canada bridge piers built by filling a sheet-pile cofferdam with graded aggregate and then intruding cement grout to make concrete under water have proven successful and structually sound. Sometimes steel H-piles are used full-height within the structure with the concrete serving as encasement.

Water Supply Developments

DESPITE some gloomy predictions last May that the waterworks industry was "moving toward a complete tailspin" because of the lack of materials, statistics at the year end showed that a nice stable volume of $109,000,000 of work was under way. Compared with the best previous year (1939), when $163 million was registered, this was a substantial achievement. And the probability of much bigger things ahead is revealed from a backlog of defined projects compiled by *Engineering News-Record* showing a total of more than $1,131,000,000 that may be spread over the next half dozen years. How rapidly this work is getting under way may be appreciated from recent announcements that New York City expects to let $40,000,000 of contracts this year; Philadelphia has begun a $75,000,000 improvement program; Phoenix, Ariz. has given contracts on its $6,000,000 program, and St. Louis has okayed a $40,000,000 program.

One of the most interesting developments of the year was the decision of Philadelphia to employ ozone for water quality improvement. A contract was let for an ozone installation with a capacity of 1,250 pounds—largest in the United States—to treat 36 mgd. Oxidation of taste, odor and color-producing impurities is the aim.

Straws in the wind that may portend changes in future practice of water sterilization include some quiet research indicating a revival of interest in the oligodynamic effect of silver, and guarded comments on the possible applications of atomic radiation for the purpose.

Sanitation Facilities Expanded

A FACTUAL MEASURE of the progress being made in the extension of sewage disposal facilities—the first since 1938 by this journal—shows the gratifying fact that more than 1,000 new treatment plants and 1,200 sewer systems were added to the nation's facilities during the war years. Although 5,685 communities are now served by treatment works, this represents only slightly more than half the needs based on population.

Strong promise of continued substantial progress is given in the backlog of identified new

projects compiled by *Engineering News-Record*, which shows a total of $1,995,000,000. Work contracted last year—despite the handicap of high prices and material shortages—was $113 million.

In contrast with the situation in the water supply field where use of ozone was given a big boost by Philadelphia's decision to employ it for quality improvement, the application of ozone for sewage treatment was scored by a group of sanitary engineers in an unusual manner (*ENR* June 20, 1946, vol. p. 948). In a report that was circulated among cities on the West Coast, the Northwest Sewage Works Association sought to discourage them "from entertaining proposals which claim ozonation as the principal means of sewage treatment." The report took issue with the claims and promotion methods being used by a company that was installing an ozone treatment plant in Kelso, Wash.

An important contribution to sanitary engineering literature was the report of the National Research Council on sewage treatment at military installations; this documentation of data relating to design and performance of installations throughout the U. S. is an invaluable reference work.

Stream Pollution Control

ALMOST 100 BILLS over the last 50 years have been introduced in the Congress on stream pollution control. This prolonged battle of words and wits revolves around the broad concept of complete jurisdiction and enforcement by a single agency of the federal government versus regulatory control exercised by the separate states with federal participation limited to research and advisory service. The latter procedure has the support of the engineering profession and, judging from recent coordination of effort, a positive decision in this direction may emanate from this year's Congress.

Major emphasis on pollution abatement is being focused on industrial waste. This is calling forth an entirely new technology in which treatment processing is intimately allied with production methods and byproduct recovery. Naturally, progress will be slow because industrial wastes are almost as varied as are the products of industry itself. But progress is being made, not the least evidence of which is a recent survey by *Engineering News-Record* showing that during the period of 1938-46—when war production and not stream pollution was emphasized—the number of industrial treatment plants increased from 771 to 1,114.

Outstanding example of aggressive state action is the "clean stream" campaign of Pennsylvania, which was launched about two years ago. Legal orders have been issued thus far to 553 municipalities and others to prepare plans for sewage treatment works and to 430 industries for the installation of remedial work.

An important move that will aid industries as well as provide basic information for stream pollution control measures is the recently announced program of the U. S. Public Health Service for drafting industrial water quality standards. This is an entirely new job for that agency, which heretofore concerned itself with drinking water standards, and may take several years for completion.

Reclamation and Flood Control

BOTH the Bureau of Reclamation and the Corps of Engineers, to whose hands development of the nation's rivers is entrusted, made 1946 a time for restarting construction jobs shut down by the war and for planning new operations on unprecedented scales. Thus there is a greater volume of reclamation work ready to enter the construction stage than ever before in the 44-year life of the bureau. And the Army Engineers have been only slightly less active in planning for flood control and navigation facilities. How much of this work will reach the construction stage in 1947 depends upon Congressional and Presidential attitudes toward appropriations.

There is a general tendency in national policy to complete projects already started so that the investment in them can be put to work. Central Valley in California and Colorado-Big Thompson are two of the big reclamation jobs in this category, while locations where flood-control works are required to complete projects include the Lower Mississippi and the Connecticut River tributaries in New England. Reclamation's Columbia Basin project and the Missouri Valley, where both agencies are involved in beginning the largest river basin project in history, are other developments that can only begin to function after large additional investments. The actual accomplishments, plans and hopes of the Army Engineers and the Bureau of Reclamation are set forth in detail in special articles in this issue.

Big Electric Utility Expansion

NOT ONLY PUBLIC POWER, as represented by reclamation and flood control dams, but private power, as represented by utility system expansion, are prominently in the current scene. New customers

connected to electricity supply lines in 1946 reached an unprecedented total. As a result the utilities have scheduled the biggest program of construction in their history—to cost $1,300,000,000. Some 3,000,000 kw. of new capacity is scheduled to go into operation this year, but it is in the 7,325,000 kw. schedule for 1948 that construction will reach the height of activity. This amount, more than double the largest previous year, will be divided 70 percent to steam and 30 percent to hydro, the ratio of the existing 50,000,000 kw. capacity of the country, including public hydro plants.

National Defense

Nor were the requirements for national defense free of significance for construction. Extensive studies were undertaken at the request of Congress looking toward recommendations for increased security to the Panama Canal. One part of the investigation relates to conversion of the lock canal to one of sea-level type, probably a billion dollar operation and certainly one of great technical difficulty. A report is to be rendered Congress this year.

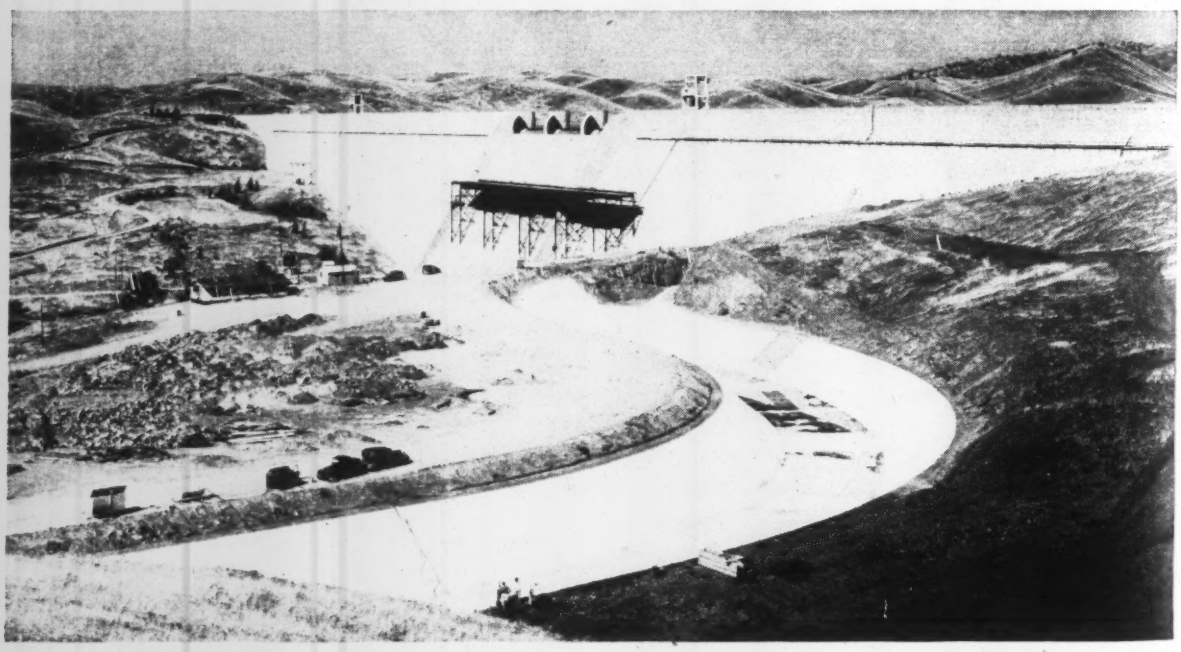
At various coast points the Navy prosecuted $70 million of large construction projects to provide facilities for storing excess vessels of its battle fleet, while the Army is doing a similar $10 million job for the merchant fleet. A large naval ordnance laboratory is being built at White Oak, Maryland, and in Liberia, Africa, the Navy is spending $30 million on a large port development.

Signaling our intentions in the Pacific, contracts totaling close to a hundred million dollars were let for permanent housing and other facilities in the Philippines, Alaska, Okinawa, Guam and the Marianas. Here at home, assembly of large areas of remote Western land presaged major construction for guided missile research and testing. And analogous to national defense development, because it stems from the atomic bomb project, was the awarding of contracts for work on nuclear power. A plant for generating steam from atomic energy was begun at Oak Ridge, Tenn., and at Schenectady and elsewhere atomic-power laboratories were placed under contract.

Thus the construction industry moved into a prominent role in the drama being staged to maintain the nation's position in a world undergoing changes both frightening and promising.

Foreign Reconstruction and Development

Among the promising changes of 1946 was the vastly increased tempo of construction and reconstruction abroad. Because of shortages of men, materials and money, war-devastated countries had to improvise on everything and temporize on the big jobs, but achievements nevertheless were noteworthy. Russia practically completed repairs to



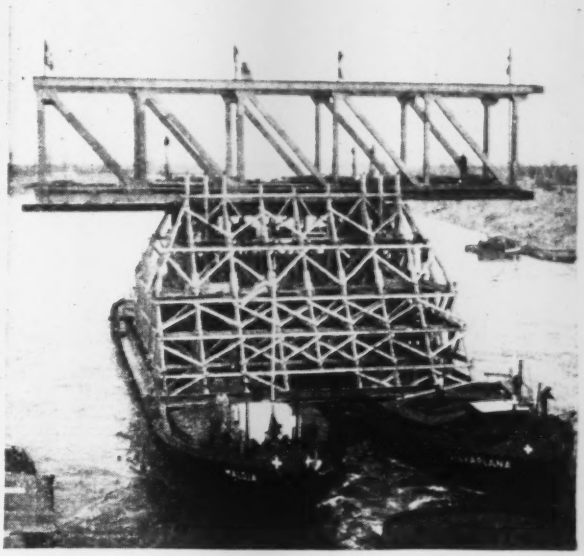
Through this cement-lined Friant-Kern Canal, water from behind Friant Dam will be led 156 miles to the south end of the Central Valley project. Some 120 miles will be under construction during 1947.

its Dnieperstroy Dam, and put the power plant into condition to receive the three new 90,000 kva. generators which were shipped from the United States in May. Holland repaired the Ijmuiden lock—largest in the world—to permit ships again to enter Amsterdam. In addition the Dutch repaired many bridges and dikes, the Moerdijk Bridge over the Rhine and the Walcheren Island dikes in the Scheldt representing the largest of the operations. France reconstructed hundreds of railroads bridges, even building a few new ones of major size, and actively pushed an expanded hydro-electric power program spearheaded by a resumption of construction on the 340-ft. dam on the upper Rhone at Genissiat.

From Switzerland, not faced with any reconstruction jobs, came news of the opening of the 30-mile Susten Road, first in the Alps built for modern highway traffic, and of plans for a 700-ft. concrete dam for a power reservoir in Schollern Canyon high in the Alps above the famous St. Gothard tunnel.

Great Britain pushed its projected redevelopment and decentralization of London by finishing plans for two of the "new towns", self-sufficient satellites of about 60,000 population each beyond a greenbelt area to be established around the city. Other elements of the Greater London plan, principally extensive revamping of railway and highway facilities, were advanced by design studies, but no construction was undertaken. The great international airport at Heathrow, west of the city, was, however, the scene of considerable field development activity. New hydro schemes in the north of Scotland moved toward the construction stage, and a 3,000-ft. span suspension bridge was designed for a Severn estuary crossing north of Bristol.

Elsewhere in the world, many large projects were undertaken or studies. Great graving docks, each nearly 1,200 ft. long, were placed in service in Sydney, Australia, and Capetown, South Africa. In Egypt, plans for a $35 million hydro-power station at Aswan Dam on the Nile were completed, and in India's Punjab province the arrival of designs and specifications for Bhakra Dam, key structure of a $130 million irrigation development, were awaited from U. S. designers. China, beset by civil war and Russian occupation in Manchuria, had little time to build for the future, yet was able, with UNRRA and U. S. aid, to complete operations for turning of the Yellow River into its original northbound channel from the one into which war-blasting of its levees had turned it. China also found time to contract with the U. S. Bureau of Reclamation for designs of a great 750-ft. dam for a power and irrigation reservoir in the Yangtze River Gorge, to include also a grandiose lock and elevator scheme to lift ships more than 500 ft. If built, the dam will require 15,000,000 cu. yd. of concrete, and thus be the largest in the world by far.



Reconstruction progress in Europe has been possible only through ingenuity and improvisation. Here the first half of an abandoned bridge is being moved up the Rhine to complete a railroad crossing at Chalampe, France.

South American countries continued to turn in significant engineering and construction performances. In Bolivia, work continued on the 300-mile highway from the seacoast to La Paz, reaching at one point an elevation of 13,000 ft. The Chimbote, Peru, coal port neared completion; work continued on the American-designed water supply for Caracas; and, also in Venezuela, American oil companies were completing a modern 200-mile highway to gain access to new producing fields. All in all, there was ample evidence from all parts of the world that engineering and construction demands are insatiable, and that to the satisfaction of many of them, American techniques and resources will make important contributions.

International Cooperation

TO THESE INSTANCES of American interest in specific projects abroad, 1946 added several examples of international cooperation on a broader scale. Two successive meetings of sanitary engineers, one in Brazil and one in Venezuela, resulted in the formation of the Inter-American Association of Sanitary Engineering. In Paris, in September, some 1,200 engineers representing 30 countries met in the first postwar international technical congress and

formed an interim World Engineering Conference to promote a permanent organization of national engineering associations for the exchange of world-wide technical knowledge. And as a third example, the International Organization for Standardization was formed at a London meeting to carry on and expand the standardization cooperation born of the war. The United States assumed active responsibilities of leadership in all of these organizations.

Professional Societies Expand

PROFESSIONAL SOCIETIES, quite generally, recorded encouraging growth during 1946 and most of them expanded their activities to meet demands from their members for new or enlarged activities.

But although membership has increased during recent years in most professional organizations, expenses have risen at a more rapid rate, with the result that the National Society of Professional Engineers increased its dues sharply during 1946 and the ASCE found itself operating in the red before the year closed, making necessary a move to increase its dues for the first time in 25 years. Part of this increased cost is due to greater activity in national affairs, such as the work of the Engineers Joint Council, and some is destined for use in the international field as noted above.

Joint Activities

ENGINEERS JOINT COUNCIL made good progress during the year in bringing the major engineering societies together on matters where joint action is desirable, such as legislation affecting engineers. Early in the year the federal government made public a report by the National Engineers Committee of the Engineers Joint Council on the demilitarization of Japanese industry, which had been prepared at the request of the government as an outgrowth of the same committee's report on German industry issued late in 1945.

A new survey of the engineering profession was undertaken by EJC's Committee on the Economic Status of the Engineer in cooperation with the U. S. Bureau of Labor Statistics. The same committee is completing work on a manual of collective bargaining for engineers.

Collective Bargaining for Engineers

Definite progress was made during 1946 toward clarifying the position of engineers and other professional employees under the National Labor Relations Act and toward providing such men with collective-bargaining agencies designed to meet their peculiar needs. Most of this progress was made on the Pacific Coast where associations of professional engineering employees, formed originally under the auspices of the American Society of Civil Engineers, but now on an independent footing, have been active in getting formal recognition as bargaining agencies for engineers.

In October, several of these regional groups began the organization of the National Professional Association of Engineers, Architects and Scientists. It is the plan for this federation to become truly national in character.

As the year closed, both the American Society of Civil Engineers and the National Society of Professional Engineers went on record as favoring amendments to the Wagner Act to clarify the position of engineers under this legislation and to confirm the right of professional employees to separate bargaining if they desire it.

Few engineers took part in strikes during the year, but some were involved indirectly in actual or threatened strikes of civil service employees. In both Dallas, Texas, and Tulsa, Okla., the courts ruled that municipal employees have no right to strike. At New York, where the mayor appointed a special advisory committee following a threatened strike of workers on the subway system, not only was a similar finding made, but it was recommended that special collective-bargaining procedures be set up to offset the inability of municipal employees to support their demands by a threat to strike.

Education and Research

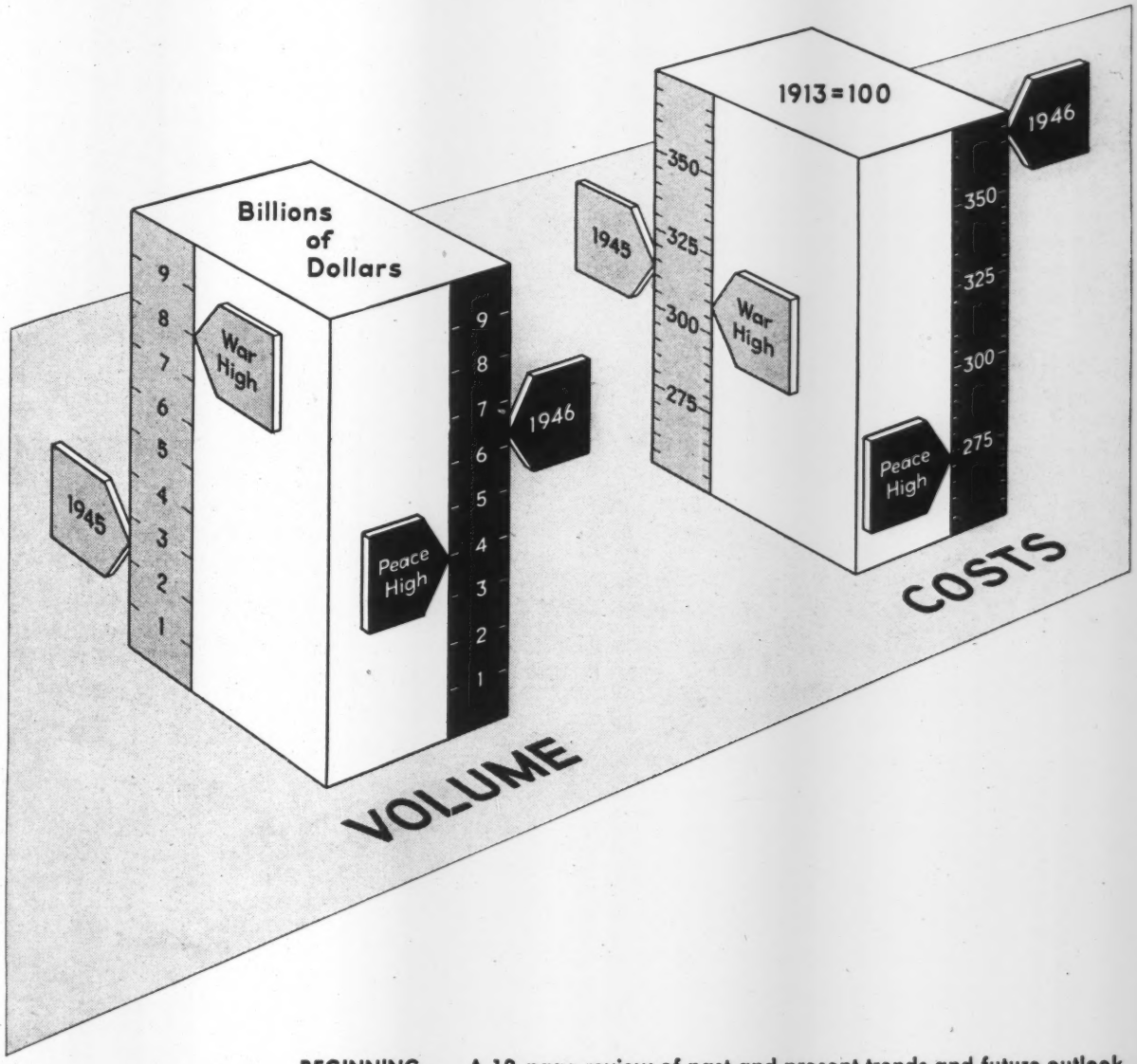
ENGINEERING EDUCATION is rapidly getting back to normal in so far as timing and curricula are concerned following the drastic changes made to meet war conditions, but all schools are overcrowded and understaffed. Of the two, the lack of adequate staff appears to be the more serious because it is due chiefly to inability to offer compensation at a level to compete with industry for the type of men the colleges need.

As the year 1946 opened it appeared probable that the engineering schools would be able to expand their research operations under a program of federal-aid that has been under consideration ever since the war showed how backward this country was in fundamental research. But because of disagreement as to how such a program should be organized and directed, the 79th Congress failed to enact the necessary legislation.

CONSTRUCTION BUSINESS

BREAKS THROUGH OLD CEILING

HEADS FOR NEW RECORDS



BEGINNING . . . A 12-page review of past and present trends and future outlook

VOLUME • FINANCING • COSTS

1946—A Year of Construction Maximums

Heavy engineering construction reported by *Engineering News-Record* topped $5 billions in 1946. This represents an increase of 126 percent over 1945 in dollar volume, compared to the previous record gain of 50 percent over a preceding year. Although 1946 was also a year of record-high construction costs, the actual physical volume gain was 103 percent.

ESTIMATED TOTAL CONSTRUCTION

Total volume of construction in 1946 estimated by *Engineering News-Record* is $10,350,000,000, 173 percent greater than the $3,798,000,000 for 1945. Most of this gain occurred in private construction which increased 221 percent over 1945 to reach a total of $7,415,000,000, 72 percent of all construction. This ratio of private construction to total construction was higher even than in 1929, when it amounted to 69 percent.

1—ESTIMATED TOTAL CONSTRUCTION

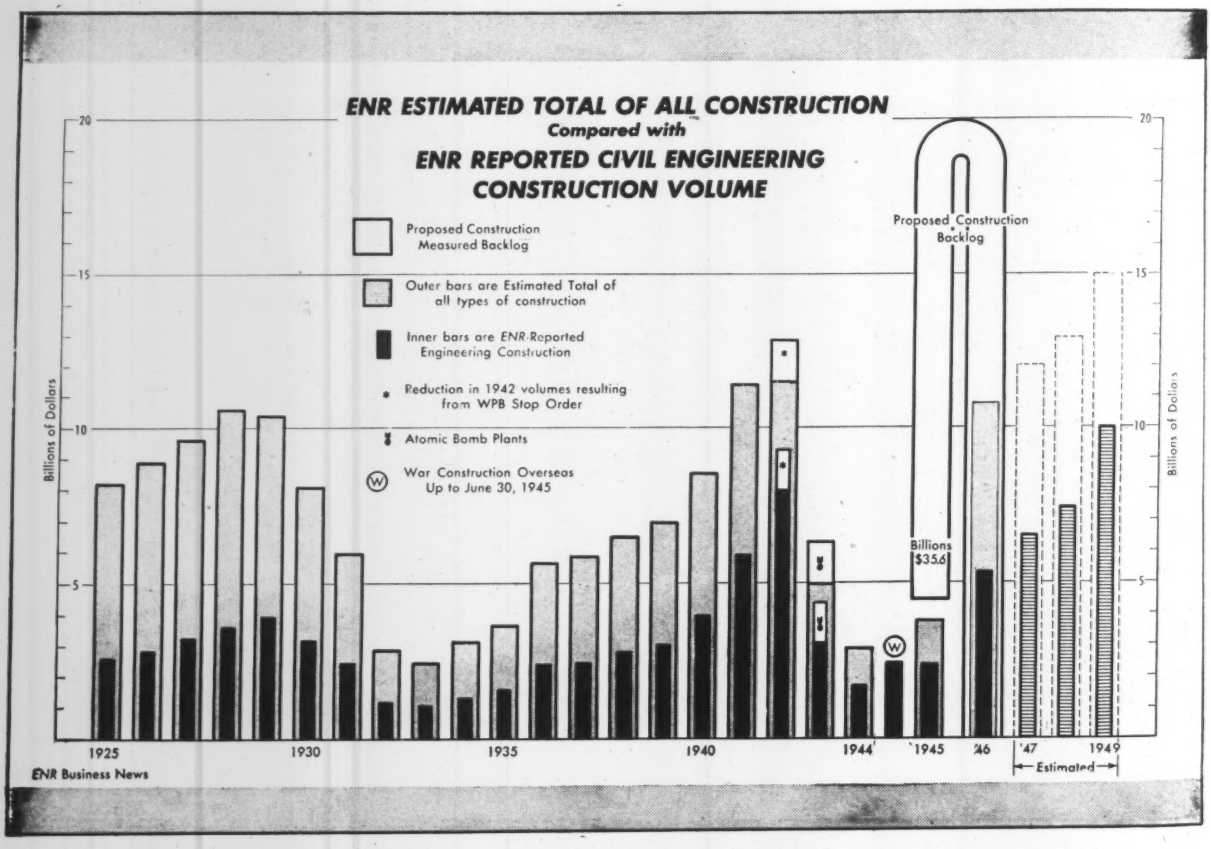
(Millions of Dollars)

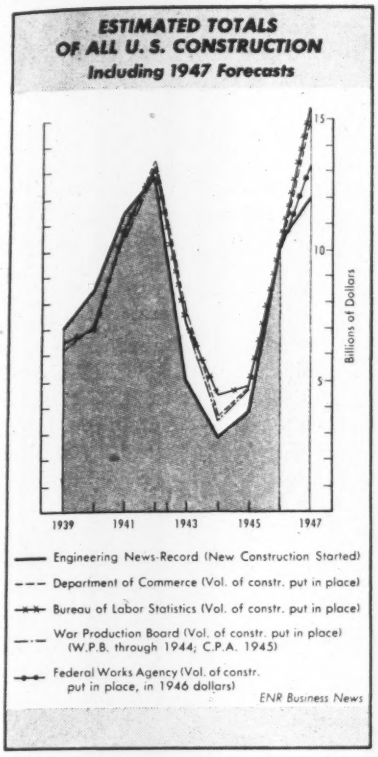
	Public	Private	Total	ENR Vol. Index
1925	2,476	5,702	8,178	201
1926	2,670	6,208	8,878	228
1927	3,073	6,522	9,595	263
1928	3,480	7,100	10,580	287
1929	3,263	7,114	10,377	317
1930	3,363	4,695	8,058	260
1931	3,098	2,832	5,930	220
1932	1,918	921	2,839	127
1933	1,533	907	2,440	102
1934	2,373	731	3,104	114
1935	2,460	1,221	3,680	134
1936	3,140	2,450	5,590	185
1937	2,806	3,046	5,852	172
1938	3,680	2,800	6,480	197
1939	3,750	3,224	6,974	211
1940	4,550	3,960	8,510	269
1941	7,200	4,196	11,396	375
1942	11,061	1,760	12,821	553
1943	3,820	1,180	5,000	176
1944	1,815	1,085	2,900	96
1945	1,490	2,308	3,798	122
1946	2,935	7,415	10,350	250

Construction of one and two-family residential homes is estimated at a record $2,790,000,000, 38 percent of the private construction total, and 27 percent of total construction. Residential construction was thus approximately 600 percent greater than the $398,000,000 estimated for 1945. State and municipal construction in 1946 is estimated at $2,185,000,000, 258 percent greater than 1945, and 21 percent of total construction. Federal construction dropped 15 percent from the previous year to a total of $750,000,000. This is only 7 percent of total construction, whereas in 1943 it accounted for 70 percent of the total. State and municipal and federal construction combined to bring total public construction to an estimated $2,935,000,000 only 28 percent of the total.

In addition to the total of $10.35 billions for new construction started, *Engineering News-Record* estimates that $5.5 billions of maintenance work was begun in 1946, making a grand total of construction activity of $15.85 billions.

Other estimates of volume are for work put in place, which include: Department of Commerce, $10.1 bil-




ESTIMATED TOTALS
OF ALL U. S. CONSTRUCTION
Including 1947 Forecasts
15
10
5
Billions of Dollars
1939
1941
1943
1945
1947
Engineering News-Record (New Construction Started)
Department of Commerce (Vol. of constr. put in place)
Bureau of Labor Statistics (Vol. of constr. put in place)
War Production Board (Vol. of constr. put in place) (W.P.B. through 1944; C.P.A. 1945)
Federal Works Agency (Vol. of constr. put in place, in 1946 dollars)
ENR Business News

lions for construction and $5.3 billions for maintenance, a total of $15.4 billions; Bureau of Labor Statistics, $10.13 billions for new construction (no estimate for maintenance); Federal Works Agency, $10.1 billions for construction and $5.3 for maintenance, a total of $15.4 billions; and Associated General Contractors, a total of $15 billions for construction and maintenance.

FORECASTS FOR 1947

Although estimates for 1947 vary, all forecast the greatest volume of construction ever experienced in the United States. The estimate for engineering construction as recorded by *Engineering News-Record* is $6,540,000,000, 26 percent greater than the $5,176,000,000 reported in 1946. Estimated total construction to be started in 1947, including one and two-family houses, and other work below the minimums recorded by *ENR*, is forecast at $12 billions, with an additional $6 billions of maintenance. The Bureau of Labor Statistics estimates total construction to be put in place in 1947 at $15.4 billions; Department of Commerce, total construction, $15.1 billions and maintenance, $6.5-7 billions; Federal Works Agency, construction, $13.3 billions and maintenance, $6.2 billions; Building Products Institute, $14 billions, and maintenance, $6 billions; and Associated General Contractors, construction and maintenance combined, $20 billions.

The *Engineering News-Record* estimate represents a conservative gain of 16 percent over 1946 for total new construction to be started in 1947. This estimate recognizes the unusually large carry over of work uncompleted in 1946. Estimates of volume of construction to be "put in place" in 1947 represent the following increases over 1946: Department of Commerce, 50 percent; Bureau of Labor Statistics, 52 percent; Federal Works Agency, 32 percent; and Associated General Contractors, 33 percent.

BACKLOG OF CONSTRUCTION

Since January, 1943, *Engineering News-Record* has recorded $35,557,452,000 in engineering construction projects proposed but not yet under construction. This total represents a continuing inventory of proposed construction, for it is the backlog less $1,302,371,000 of projects that advanced in 1946 to a "contract awarded" status. During 1946, also, $7,555,530,000 of proposed projects were added to the measured backlog. This $7,555,530,000 compares with $11,386,894,000 in 1945, $11,513,939,000 in 1944, and $5,101,089,000 in 1943. The reservoir of needed projects alone could supply 7 years of construction at the 1946 record volume rate.

Geographically, the Middle Atlantic and West of the Mississippi states have the largest volume of advance construction planning—each with 25 percent of the total backlog. Far West accounts for 19 percent; Middle West, 16 percent; South, 10 percent; and New England, 5 percent.

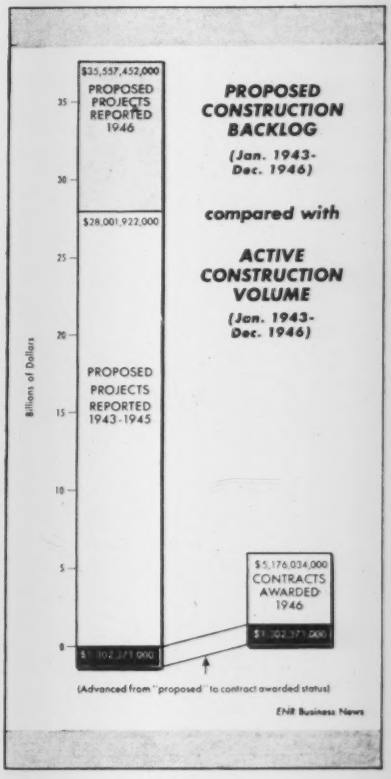
Projected public construction totals $27,852,529,000, 78 percent of the backlog, while private construction amounting to $7,704,923,000, comprises the remaining 22 percent. Considering types of construction, earthwork, irrigation, and drainage and public buildings have had the most forward planning, each with a backlog of 21 percent of the total.

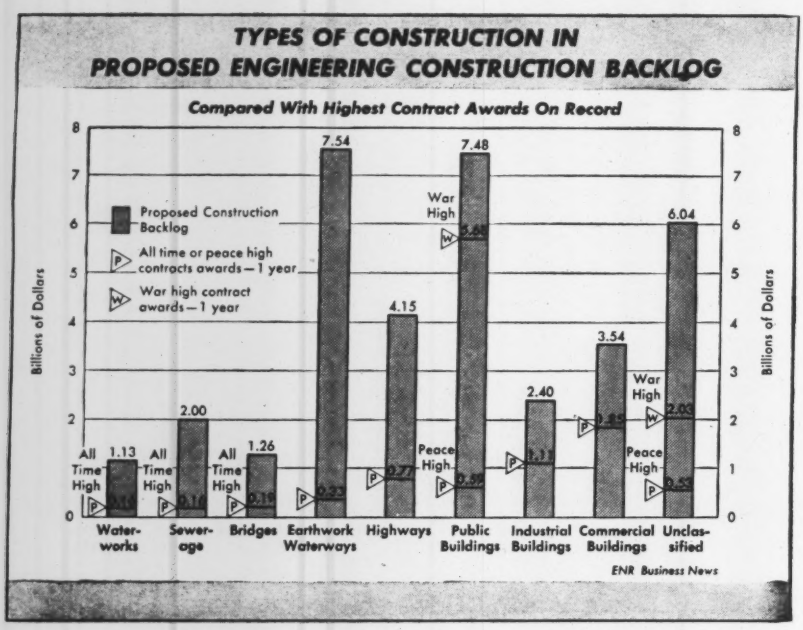
Next in order of importance are: unclassified construction, 17 percent of total backlog; streets and roads, 12 percent; commercial buildings, 10 percent; industrial buildings, 7 percent; sewerage, 5 percent; bridges, 4 percent; and waterworks, 3 percent.

ENR—REPORTED CONSTRUCTION

Heavy engineering construction reported by *Engineerings News-Record* ran up a total dollar volume of $5,176,034,000 in 1946. This total is 126 percent above 1945 volume, and 106 percent greater than the average peace year from 1925 through 1940. It is 12 percent less than the "war-preparatory" year of 1941, and 35 percent less than the record-high year of 1942. Private construction came to the fore in 1946 with a total of $3,157,671,000, 61 percent of the whole, compared to $2,018,363,000, or 39 percent for public construction. This is the highest ratio that private construction has achieved since 1929.

Private engineering construction is 176 percent above 1945 and public, 76 percent above. Of the public total, $599,271,000 is for federal work, 20 percent below 1945, and $1,419,092,000 is for state and municipal work, 259 percent above a year ago. Federal construction, held down by





the moratorium order of August 6, 1946, averaged $14,901,000 per week prior to the moratorium, compared to $6,121,000 subsequently.

By classes of construction, earthwork, irrigation and drainage volume, $327,605,000, made the greatest gain in 1946. It increased 477 percent over the 1945 total of $56,759,000 to establish a record 22 percent greater than the previous high year of 1938.

Commercial building construction, totaling $1,846,173,000, gained 377 percent over the $387,273,000 recorded for 1945, and topped the previous record established in 1929 by 11 percent. The effort to channel materials and labor into housing construction resulted in a private mass housing total of $1,518,407,000, 82 percent of all commercial buildings, and 500 percent above the 1945 pri-

II—*BACKLOG OF PROPOSED ENGINEERING CONSTRUCTION*

As Reported to Engineering News-Record through December, 1946
(thousands of dollars)

States	Proposed Public Construction							Federal Government Work	Proposed Private Construction				Total Proposed Construction			States
	Water-works	Sewer-age	Bridges	Earthwork Irr.-Drain.	Streets and Roads	Buildings	Un-classified		Bridges	Indus-trial Bldgs.	Commer-cial Bldgs.	Un-classified	Private	Public	Total	
Maine	680	4,548	733	3,178	29,842	26,512	21,648	11,912	.....	3,150	5,245	1,354	9.749	87 142	**96,891**	Maine
New Hampshire	2,011	1,927	6,322	1,051	12,205	19,057	16,364	10,159	.....	7,376	9,310	9,127	25,813	58,937	**84,750**	New Hampshire
Vermont	1,755	1,577	100	57,376	1,773	12,869	13,999	59,019	.....	310	3,510	1,465	5,285	89,449	**94,734**	Vermont
Massachusetts	36,801	66,655	27,791	30,284	53,969	285,144	80,522	164,060	.....	22,301	77,424	12,919	112,644	581,166	**693,810**	Massachusetts
Rhode Island	4,775	4,514	15,205	688	20,950	31,489	13,639	13,326	.....	7,149	28,123	1,065	36,337	91,260	**127,597**	Rhode Island
Connecticut	2,677	31,039	10,496	86,836	82,641	126,472	50,113	120,599	155	35,237	129,817	6,851	172,060	390,274	**562,334**	Connecticut
New England	**48,699**	**110,260**	**60,647**	**179,413**	**201,380**	**501,543**	**196,286**	**379,075**	**155**	**75,523**	**253,429**	**32,781**	**361,888**	**1,298,228**	**1,660,116**	**New England**
New York	181,912	292,436	179,219	115,288	496,243	1,281,118	1,378,651	277,902	.....	159,171	750,427	10,223	919,821	3,924,867	**4,844,688**	New York
New Jersey	65,269	79,151	37,228	25,997	124,041	229,441	96,021	43,622	40	82,893	77,885	67,726	228,544	657,148	**885,692**	New Jersey
Pennsylvania	97,905	181,023	70,168	213,383	290,289	351,156	319,668	304,012	1,753	150,002	232,993	36,852	421,600	1,523,592	**1,945,192**	Pennsylvania
Maryland	40,781	25,472	20,658	14,034	158,971	177,570	41,736	69,560	.....	32,515	74,980	5,133	112,628	479,222	**591,850**	Maryland
Dist. of Col.	8,897	11,602	20,509	2,500	40,271	228,217	83,932	225,226	.....	80	17,330	628	18,038	395,928	**413,966**	Dist. of Col.
Delaware	1,754	8,584	25,170	250	15,650	18,885	3,895	6,360	.....	23,281	7,895	962	32,138	74,188	**106,326**	Delaware
Middle Atlantic	**396,518**	**598,268**	**352,952**	**371,452**	**1,125,465**	**2,286,387**	**1,923,903**	**926,682**	**1,793**	**447,942**	**1,161,510**	**121,524**	**1,732,769**	**7,054,945**	**8,787,714**	**Middle Atlantic**
Virginia	4,215	23,945	31,828	121,856	38,145	79,518	28,134	151,867	.....	61,358	8,020	18,748	88,126	327,641	**415,767**	Virginia
West Virginia	950	19,003	1,033	19,500	4,941	33,576	37,290	32,014	.....	888	5,235	7,773	13,896	116,293	**130,189**	West Virginia
North Carolina	15,709	13,818	4,354	201,302	14,690	95,536	27,255	251,392	95	25,185	52,523	17,358	95,161	372,664	**467,825**	North Carolina
South Carolina	7,165	7,205	2,834	99,310	13,035	49,574	22,185	110,976	...	30,163	8,700	8,096	46,959	201,308	**248,267**	South Carolina
Georgia	10,118	8,699	775	18,740	11,934	97,870	31,577	50,465	378	45,584	42,383	22,924	111,269	179,713	**290,982**	Georgia
Florida	30,235	60,161	32,474	77,710	28,530	106,170	50,258	105,531	.....	12,837	47,810	20,437	81,084	385,538	**466,622**	Florida
Alabama	6,348	11,051	3,032	64,080	7,575	69,338	28,925	85,844	.....	42,412	42,094	27,411	111,917	190,849	**302,766**	Alabama
Mississippi	2,886	7,668	1,493	39,842	8,174	24,288	13,632	53,937	.....	30,205	10,525	34;113	74,843	97,983	**172,826**	Mississippi
Louisiana	5,649	21,875	21,847	179,917	9,225	75,570	57,716	226,800	600	19,248	38,501	16,096	74,445	371,799	**446,244**	Louisiana
Kentucky	3,849	10,016	10,164	165	38,946	24,684	7,127	16,863	...	7,571	3,665	16,543	27,779	94,951	**122,730**	Kentucky
Tennessee	4,925	41,811	3,007	69,573	27,728	117,809	21,016	102,610	40	15,122	31,713	25,933	72,808	285,869	**358,677**	Tennessee
Southern	**92,049**	**225,252**	**112,841**	**891,995**	**202,923**	**774,433**	**325,115**	**1,188,299**	**1,113**	**290,573**	**291,169**	**215,432**	**798,287**	**2,624,608**	**3,422,895**	**Southern**
Ohio	45,509	139,847	143,637	43,183	302,112	405,726	125,932	73,364	120	199,157	164,260	66,521	430,058	1,205,946	**1,636,004**	Ohio
Indiana	3,500	61,435	54,435	30,611	68,497	149,198	40,278	69,004	.....	107,974	58,355	28,681	195,010	407,954	**602,964**	Indiana
Illinois	83,205	189,564	92,471	195,118	353,017	429,248	232,569	207,071	.....	136,522	117,170	44,143	297,835	1,575,192	**1,873,027**	Illinois
Wisconsin	6,703	25,850	13,079	753	73,337	100,372	30,978	22,826	.....	38,932	29,291	28,373	96,596	251,072	**347,668**	Wisconsin
Michigan	55,197	147,881	66,513	11,324	137,455	599,047	305,803	62,739	.....	45,368	21,547	58,905	125,820	1,323,220	**1,449,040**	Michigan
Middle West	**194,114**	**564,577**	**370,135**	**280,989**	**934,418**	**1,683,591**	**735,560**	**435,004**	**120**	**527 953**	**390,623**	**226,623**	**1,145,319**	**4,763,384**	**5,908,703**	**Middle West**
Minnesota	9,281	19,103	9,549	23,369	25,826	106,469	43,156	21,106	25	33,596	31,236	19,869	84,726	236,753	**321,479**	Minnesota
Iowa	5,038	14,739	6,904	23,113	10,985	49,160	13,742	34,254	.....	4,708	16,248	18,434	39,390	123,681	**163,071**	Iowa
Missouri	24,125	39,308	45,359	194,251	320,054	273,164	96,528	293,024	.....	83,428	92,486	88,097	264,011	992,789	**1,256,800**	Missouri
Arkansas	4,957	9,622	21,670	239,172	23,785	34,314	36,759	245,844	150	24,559	13,720	25,655	64,084	370,279	**434,363**	Arkansas
North Dakota	4,435	3,831	173	228,342	661	10,506	4,117	232,094	.....	1,830	1,045	12,551	15,426	252,065	**267,491**	North Dakota
South Dakota	3,206	2,392	80	274,956	1,260	3,480	5,803	275,008	.....	1,335	1,300	12,287	14,922	291,177	**306,099**	South Dakota
Nebraska	4,044	14,377	3,030	184,824	21,764	49,502	24,950	216,592	.....	7,619	5,435	33,685	46,739	302,491	**349,230**	Nebraska
Kansas	10,644	8,841	2,442	158,559	9,566	64,647	8,021	187,657	.....	31,371	7,787	133,667	172,825	262,720	**435,545**	Kansas
Oklahoma	24,465	15,104	10,487	269,130	58,699	107,091	77,550	283,661	489	16,015	36,492	107,678	160,674	562,526	**723,200**	Oklahoma
Texas	85,190	105,633	54,439	590,373	287,244	429,962	246,135	540,578	980	459,548	519,587	340,632	1,320,747	1,798,976	**3,119,723**	Texas
Montana	3,273	6,409	63,748	307,830	27,815	37,257	12,833	311,717	.....	13,366	4,197	6,728	24,291	459,165	**483,456**	Montana
Wyoming	91	1,460	785	215,988	3,817	5,499	4,021	219,282	.....	7,115	150	16,193	23,458	231,661	**255,119**	Wyoming
Colorado	15,144	2,774	290	334,221	14,352	47,691	23,256	366,051	.....	14,195	15,632	33,654	63,481	437,728	**501,209**	Colorado
New Mexico	1,876	1,833	1,525	48,501	2,713	18,041	36,313	58,244	.....	10,525	4,194	50,412	65,131	110,802	**175,933**	New Mexico
W. of Miss.	**195,769**	**245,426**	**220,481**	**3,092,629**	**808,541**	**1,236,783**	**633,184**	**3,285,112**	**1,644**	**709,210**	**749,509**	**899,542**	**2,359,905**	**6,432,813**	**8,792,718**	**W. of Miss.**
Idaho	1,485	3,017	4,142	171,729	53,686	20,440	13,921	177,768	.....	6,937	3,400	6,775	17,112	268,420	**285,532**	Idaho
Utah	7,102	14,716	1,959	144,981	43,339	26,449	14,780	154,779	.....	4,470	5,116	4,733	14,319	253,326	**267,645**	Utah
Arizona	7,740	2,765	850	595,867	11,848	12,939	21,476	610,755	.....	2,834	4,631	9,933	17,398	653,485	**670,883**	Arizona
Nevada	490	2,956	4,500	38,953	41,438	23,820	5,199	22,115	.....	2,090	12,750	62	14,902	117,356	**132,258**	Nevada
Washington	51,217	33,433	48,272	580,218	174,461	235,111	70,709	648,463	400	39,599	56,426	14,179	110,604	1,193,421	**1,304,025**	Washington
Oregon	10,785	22,548	24,673	254,222	88,493	81,407	32,068	296,098	.....	49,179	53,477	15,863	118,519	514,186	**632,715**	Oregon
California	125,205	172,431	56,607	940,526	467,527	597,360	318,691	1,045,940	631	245,709	562,936	204,625	1,013,901	2,678,347	**3,692,248**	California
Far West	**204 024**	**251.866**	**141.003**	**2,726,496**	**880.792**	**997.526**	**476.844**	**2,955,918**	**1,031**	**350,818**	**698,736**	**256,170**	**1,306,755**	**5,678,55(**	**6,985,306**	**Far West**
United States	**1,131,173**	**1,995,649**	**1.258,059**	**7,542,974**	**4,153,519**	**7,480,263**	**4,290,892**	**9,170,090**	**5,856**	**2,402,019**	**3,544,976**	**1,752,072**	**7,704,923**	**27,852,529**	**35,557,452**	**United States**
Canada	104,669	202,087	232,904	475,637	1,251,536	762,496	982,204	.....	380	293,621	366,450	633,571	1,294,022	4,011,533	5,305,555	Canada

vate mass housing volume of $253,020,000 as recorded by *ENR*.

Highway construction, with a year's total of $769,387,000, also established a new high, a gain of 239 percent over 1945, and 13 percent over the previous high year of 1940.

Industrial building construction was the fourth class of work to establish a new high in 1946, in spite of being impeded by regulations designed to divert materials to housing. The year's total of $1,113,251,000 exceeded by 75 percent the previous record of $635,170,000 achieved in 1945.

By type of industry industrial building contract awards in 1946 were for process industries $499,302,000, 45 percent of all industrial building; metal working plants, $151,452,000, 14 percent; miscellaneous factories, $131,834,000, 12 percent; food industries, $118,997,000, 10 percent; public utilities, $93,330,000, 8 percent; transportation service buildings, $50,742,000, 5 percent; metal refining and rolling plants, $39,833,000, 4 percent; textile industries, $16,325,000, 1 percent; wood industries, $10,391,000, 0.9 percent; and radio factories, $1,045,000, 0.1 percent.

Other gains over 1945 volume were sewerage, 229 percent; bridges, 142 percent; and waterworks, 79 percent.

Only two classes of construction dropped in 1946: public buildings, 11 percent, and unclassified construction 5 percent. Unclassified construction dropped due to the decrease in military airports and shipyard facilities. Unclassified public construction in 1946 totaled $157,957,000, 38 percent less than in 1945, while unclassified private totaled $196,155,000, 66 percent greater than 1945.

The 1946 unclassified construction volume is made up of private, 55

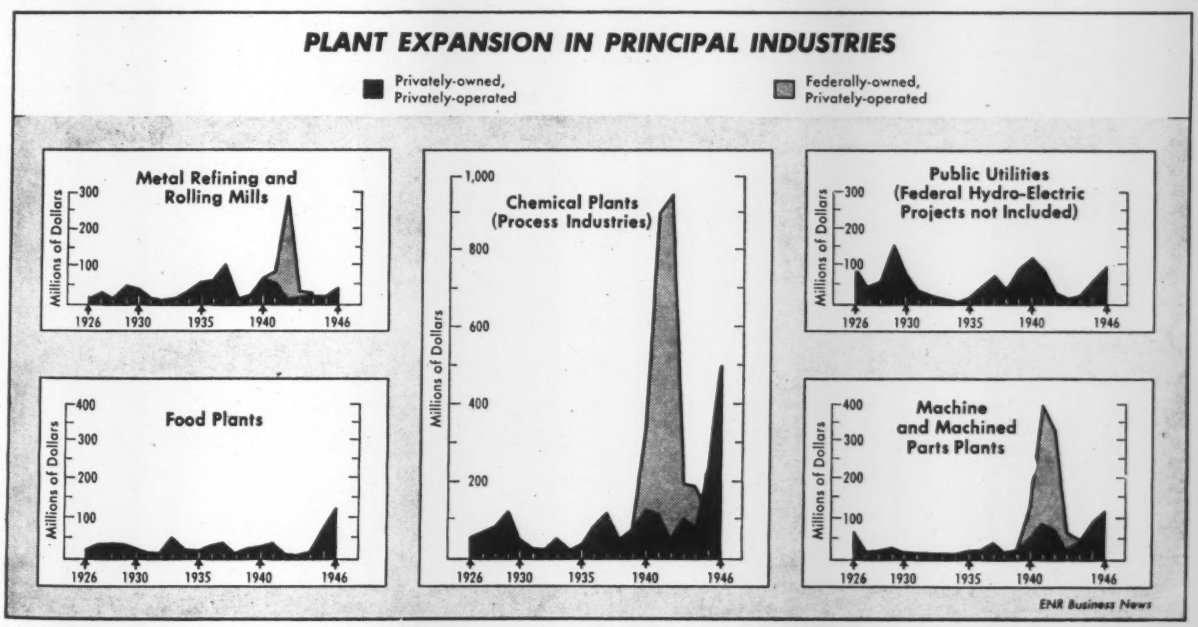
III—CONTRACTS FOR INDUSTRIAL BUILDING CONSTRUCTION BY INDUSTRIES

(Federally-owned privately-operated plants added to private construction 1942-46)

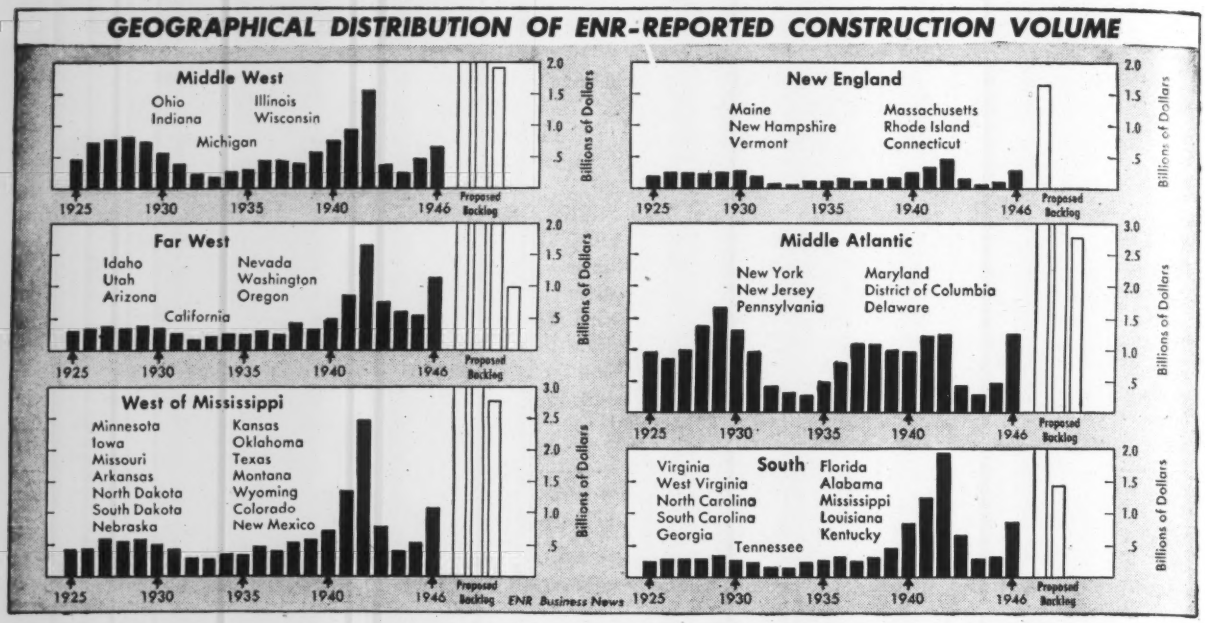
(Value in Thousands of Dollars, *ENR* Reports)

	1942			1943			1944			1945			1946
	Pvt. Own.	Fed. Own.	Total	Pvt. Own.	Fed. Own.	Total	Pvt. Own.	Fed. Own.	Total	Pvt. Own.	Fed. Own.	Total	Pvt. Own.
Transportation Service													
1. Railroads	$2,473	.....	$2,473	$3,180	.....	$3,180	$5,488	.....	$5,488	$10,961	.....	$10,961	$17,198
2. Automotive	1,733	.....	1,733	1,029	.....	1,029	2,225	.....	2,225	15,512	.....	15,512	33,544
Public Utilities	29,225	.....	29,225	6,555	$300	6,855	14,769	.....	14,769	52,150	.....	52,150	93,330
Process Industries (a)	42,263	$902,206	944,469	104,024	82,201	186,225	75,376	$108,453	183,829	245,129	$61,675	306,804	499,302(c)
Food Industries (b)	9,544	500	10,044	9,134	.....	9,134	11,080	1,229	12,309	64,688	.....	64,688	118,997
Metal Refining and Rolling	9,217	272,325	281,542	13,875	11,409	25,284	17,439	3,617	21,056	18,218	.....	18,218	39,833
Metal Working Plants													
1. Auto Factories	530	.....	530	210	200	410	540	.....	540	41,790	.....	41,790	29,390
2. Aircraft Factories	16,687	314,688	331,375	1,406	20,045	21,451	4,052	8,162	12,214	3,848	2,825	6,673	1,698
3. Foundries	6,629	22,991	29,620	1,368	3,360	4,728	2,861	2,680	5,541	2,333	1,040	3,373	5,693
4. Mach. and Mach. Parts	62,338	272,349	334,687	16,631	42,312	58,943	27,820	16,652	44,472	86,970	7,569	94,539	114,671
Radio	2,300	1,000	3,300	498	40	538	167	.....	167	7,540	.....	7,540	1,045
Textiles (Excluding rayon)	366	.....	366	320	.....	320	823	.....	823	6,840	.....	6,840	16,325
Wood Industries	700	.....	700	1,049	.....	1,049	517	.....	517	8,592	.....	8,592	10,391
Miscellaneous													
1. General Factories	15,729	123	15,852	6,825	255	7,080	9,039	90	9,129	65,742	290	66,032	122,647
2. Refrigeration and Cold Storage	585	.....	585	730	.....	730	2,118	.....	2,118	4,857	.....	4,857	9,187
Total	$200,319	$1,786,182	$1,986,501	$166,834	$160,122	$326,956	$174,314	$140,883	$315,197	$635,170	$73,399	$708,569	$1,113,251(c)

(a) Includes distilleries. (b) Includes breweries and wineries. (c) In addition to these figures, contracts totaling $25,000 were awarded for federally-owned privately operated plants



GEOGRAPHICAL DISTRIBUTION OF ENR-REPORTED CONSTRUCTION VOLUME



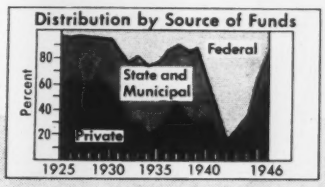
IV—ENGINEERING CONSTRUCTION CONTRACTS REPORTED TO ENGINEERING NEWS-RECORD IN 1946

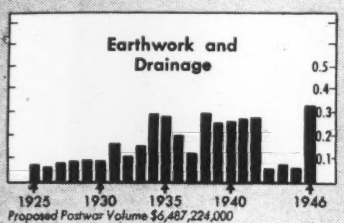
Engineering News-Record *reports continental U. S. Construction projects of the following minimum costs—waterworks, excavation, drainage and irrigation,* $22,500; *other public works,* $40,000; *industrial buildings,* $55,000); *other buildings,* $205,000;

Thousands of Dollars (000 Omitted)

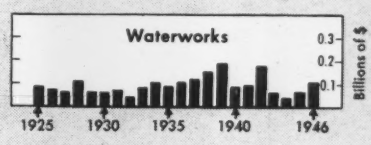
States	Public Works Contracts: Water-works	Sewer-age	Bridges	Earthwork Irr.-Drain.	Streets, Roads	Buildings: Indus-trial	Com-mercial	Public	Un-classi-fied	Federal Gov't. Work	All Construction: Private	Public	1946 TOTAL	1945 TOTAL	% Change 1945 to 1946	States
Maine	29	.....	6,180	17	13,932	2,215	4,240	2,696	1,102	75	7,159	23,252	30,411	6,041	+403	Maine
New Hampshire	40	.....	720	845	2,041	4,021	1,670	538	85	810	5,776	4,184	9,960	4,896	+103	New Hampshire
Vermont	.....	.....	436	2,429	2,892	415	650	457	95	2,471	1,160	6,214	7,374	1,192	+519	Vermont
Massachusetts	2,682	3,508	1,394	1,880	9,604	16,490	81,029	13,564	7,237	9,986	98,670	38,718	137,388	46,343	+196	Massachusetts
Rhode Island	413	30	48	43	92	4,872	8,640	6,122	1,334	1,179	14,667	6,927	21,594	8,221	+163	Rhode Island
Connecticut	1,048	1,847	4,785	1,092	9,528	21,244	39,727	4,550	1,960	2,860	62,359	23,422	85,781	32,305	+166	Connecticut
New England	**4,212**	**5,385**	**13,563**	**6,306**	**38,089**	**49,257**	**135,956**	**27,927**	**11,813**	**17,381**	**189,791**	**102,717**	**292,508**	**98,998**	**+195**	**New England**
New York	22,648	5,765	15,146	12,923	42,030	21,717	133,474	80,638	34,961	40,533	155,593	213,709	**369,302**	140,433	+163	New York
New Jersey	341	916	3,334	2,285	9,400	27,056	57,758	1,904	2,705	4,713	85,164	20,535	**105,699**	50,013	+111	New Jersey
Pennsylvania	4,957	3,765	2,809	3,730	53,825	72,705	416,232	8,418	13,850	15,560	492,557	87,734	**580,291**	158,817	+265	Pennsylvania
Maryland	1,039	1,843	4,893	133	7,311	18,668	45,992	14,956	9,937	17,715	64,890	39,882	**104,772**	52,072	+101	Maryland
Dist. of Columbia	61	1,116	879	98	2,366	766	5,701	7,976	339	5,982	6,563	12,739	**19,302**	20,960	− 8	Dist. of Columbia
Delaware	218	69	.....	86	1,724	14,731	21,298	391	443	239	46,194	2,766	**48,960**	6,605	+641	Delaware
Middle Atlantic	**29,264**	**13,474**	**27,061**	**19,255**	**116,656**	**155,643**	**690,455**	**114,283**	**62,235**	**84,742**	**850,961**	**377,365**	**1,228,326**	**428,900**	**+186**	**Middle Atlantic**
Virginia	1,034	3,476	1,370	915	25,243	12,890	5,591	6,067	2,433	9,939	18,777	40,242	**59,019**	53,000	+ 11	Virginia
West Virginia	.....	30	724	1,838	6,942	20,621	925	1,084	1,725	1,927	22,631	10,658	**33,289**	15,558	+114	West Virginia
North Carolina	2,470	712	2,426	71	23,761	10,119	9,472	10,813	8,922	10,655	24,396	44,370	**68,766**	42,174	+ 63	North Carolina
South Carolina	1,351	1,371	5,258	5,242	19,566	34,235	11,122	8,715	4,749	11,524	47,633	43,976	**91,609**	7,970	+1,049	South Carolina
Georgia	3,918	1,315	3,563	13,579	25,002	44,985	40,493	6,128	5,129	14,296	90,310	53,802	**144,112**	26,380	+446	Georgia
Florida	3,766	2,099	4,652	5,344	18,333	35,003	32,041	6,925	10,679	11,469	69,427	49,415	**118,842**	42,802	+178	Florida
Alabama	1,614	1,375	1,264	419	22,820	22,084	51,004	11,381	9,044	3,817	81,723	39,282	**121,005**	34,025	+256	Alabama
Mississippi	.....	75	21	3	12,381	12,033	5,398	2,245	4,030	650	21,359	14,827	**36,186**	11,159	+224	Mississippi
Louisiana	1,417	1,214	1,029	7,853	10,095	9,606	11,661	3,617	2,436	6,840	22,866	26,062	**48,928**	32,273	+ 52	Louisiana
Kentucky	133	.....	2,639	6,140	18,561	810	825	2,722	886	6,575	2,521	30,195	**32,716**	18,420	+ 78	Kentucky
Tennessee	1,590	968	2,242	20,164	13,294	51,422	11,864	6,963	1,167	23,397	63,808	45,866	**109,674**	23,077	+375	Tennessee
Southern	**17,293**	**12,635**	**25,188**	**61,568**	**195,998**	**253,208**	**180,396**	**66,660**	**51,200**	**101,089**	**465,451**	**398,695**	**864,146**	**306,838**	**+182**	**Southern**
Ohio	4,153	2,397	3,588	3,890	24,971	58,962	52,287	8,701	22,043	12,075	130,349	50,643	**180,992**	167,499	+ 8	Ohio
Indiana	2,497	909	2,490	503	19,622	14,466	16,334	6,452	2,496	624	32,905	32,864	**65,769**	45,479	+ 45	Indiana
Illinois	3,279	23,731	7,479	4,108	26,933	62,252	48,224	15,058	11,488	8,389	117,085	85,467	**202,552**	119,850	+ 69	Illinois
Wisconsin	1,010	5,025	724	454	19,006	18,699	7,543	5,978	3,989	1,500	28,502	33,926	**62,428**	41,042	+ 52	Wisconsin
Michigan	10,457	1,218	3,524	264	17,271	52,869	9,357	24,438	1,686	2,308	63,159	57,925	**121,084**	55,230	+119	Michigan
Middle West	**21 396**	**33,280**	**17,805**	**9,219**	**107,803**	**207,248**	**133,745**	**60,627**	**41,702**	**24,896**	**372,000**	**260,825**	**632,825**	**429,100**	**+ 47**	**Middle West**
Minnesota	1,122	2,223	146	1,369	17,952	16,328	9,436	5,933	3,431	1,488	28,750	29,190	**57,940**	29,845	+ 94	Minnesota
Iowa	695	660	4,285	1,842	15,302	41,875	2,150	4,210	4,985	3,606	46,673	29,331	**76,004**	16,615	+357	Iowa
Missouri	333	243	1,811	6,781	14,040	53,059	34,663	3,317	9,908	7,270	95,938	28,217	**124,155**	50,220	+147	Missouri
Arkansas	1,279	511	540	2,653	8,179	4,701	440	5,554	2,810	7,457	7,249	19,418	**26,667**	9,700	+175	Arkansas
North Dakota	635	401	1,303	64	4,714	110	.....	2,380	5,183	5,176	4,895	9,895	**14,790**	7,280	+103	North Dakota
South Dakota	116	195	177	4,693	6,708	350	.....	4,860	1,110	9,476	1,361	16,848	**18,209**	5,332	+242	South Dakota
Nebraska	48	191	.....	6,694	8,606	1,665	3,737	2,851	2,598	7,407	6,833	19,557	**26,390**	19,494	+ 35	Nebraska
Kansas	735	1,114	3,896	11,078	22,918	2,820	8,304	164	2,473	11,241	13,395	40,107	**53,502**	21,263	+152	Kansas
Oklahoma	779	1,671	4,231	23,804	19,755	1,344	2,150	6,542	4,039	20,310	5,765	58,550	**64,315**	29,712	+116	Oklahoma
Texas	11,805	14,770	4,030	12,984	63,434	154,858	137,850	29,164	56,965	20,712	343,538	142,322	**485,860**	270,253	+ 80	Texas
Montana	609	319	512	2,153	8,580	738	800	4,225	1,877	7,387	3,318	16,495	**19,813**	7,931	+150	Montana
Wyoming	700	.....	1,098	11,308	6,191	.....	.....	2,044	1,312	14,454	210	22,443	**22,653**	4,356	+420	Wyoming
Colorado	533	292	174	21,337	3,758	50	925	1,076	825	23,342	1,800	27,170	**28,970**	10,905	+166	Colorado
New Mexico	439	70	.....	2,103	10,154	40	300	7,163	1,826	11,775	551	21,544	**22,095**	15,600	+ 42	New Mexico
West of Miss.	**19,828**	**22,660**	**22,203**	**108,863**	**210,291**	**277,938**	**200,755**	**79,483**	**99,342**	**160,101**	**560,276**	**481,087**	**1,041,363**	**498,506**	**+109**	**West of Miss.**
daho	.....	172	546	3,877	5,680	7,774	500	936	583	5,202	8,723	11,345	**20,068**	8,225	+144	Idaho
Utah	413	162	194	1,057	3,743	1,604	1,125	689	650	2,246	2,729	6,908	**9,637**	8,205	+ 17	Utah
Arizona	.....	197	.....	22,752	3,328	1,830	1,250	3,331	5,071	26,495	7,980	29,779	**37,759**	5,899	+371	Arizona
Nevada	.....	78	.....	655	6,199	80	5,450	775	411	1,404	5,805	7,843	**13,648**	16,752	− 19	Nevada
Washington	5,678	2,172	3,805	39,944	12,588	23,238	37,917	17,904	14,750	59,174	64,483	93,513	**157,996**	64,864	+144	Washington
Oregon	2,474	1,166	1,322	2,315	15,560	16,735	109,770	5,834	8,246	16,354	129,035	34,387	**163,422**	29,471	+455	Oregon
California	8,601	22,208	16,984	51,794	53,452	118,696	348,854	35,638	58,109	100,187	500,437	213,899	**714,336**	393,650	+ 81	California
Far West	**17,166**	**26,155**	**22.851**	**122.394**	**100,550**	**169.957**	**504.866**	**65.107**	**87.820**	**211,062**	**719,192**	**397.674**	**1,116,866**	**527,066**	**+112**	**Far West**
U. S. 1946	109,159	113,589	128,671	327,605	769,387	1,113,251	1,846,173	414,087	354,112	599,271	3,157,671	2,018,363	5,176,034	.....	.....	U. S. 1946
U. S. 1945	61,039	34,560	53,080	56,759	227,258	635,170	387,273	462,909	371,360	750,000	1,144,384	1,145,024	.....	2,289,408	.....	U. S. 1945
% Change '45 to '46	+79	+229	+142	+477	+239	+75	+377	−11	−5	−20	+176	+76	.....	.....	+126	% Change '45 to '46
Canada, 1946	**5,244**	**6,064**	**1,704**	**8,688**	**34,521**	**116,668**	**63,278**	**47,691**	**26,243**	.....	**196,745**	**113,356**	**310,101**	.....	**+ 89**	**Canada, 1946**
Canada, 1945	6,987	3,350	1,910	2,241	18,162	50,256	19,251	54,879	7,025	.....	73,755	90,306	.....	164,061	.....	Canada, 1945

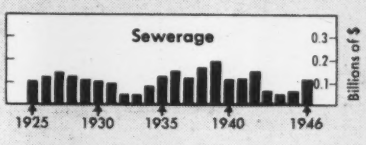
ENR-REPORTED CONSTRUCTION VOLUME—BY CLASS OF WORK

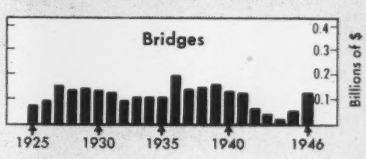


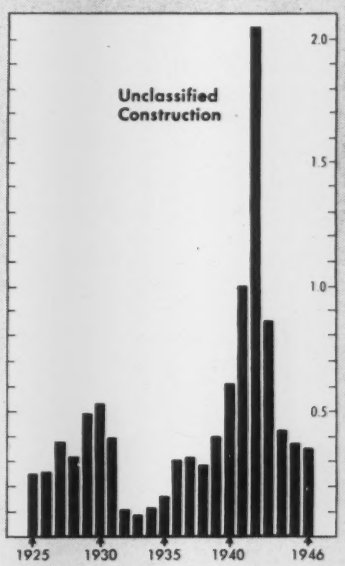


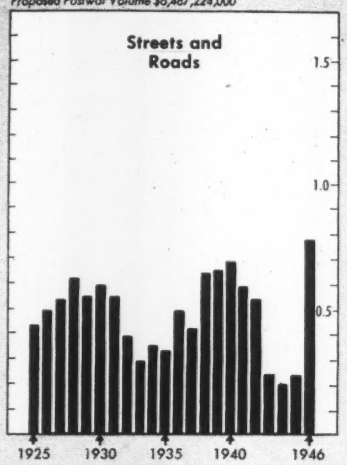
Proposed Postwar Volume $6,487,224,000

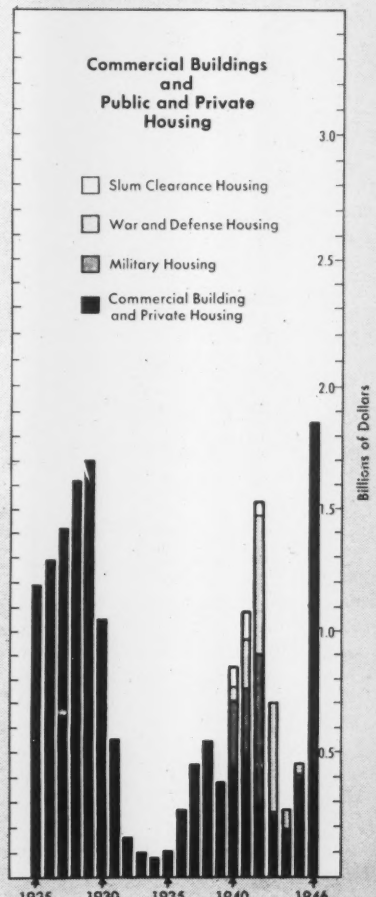


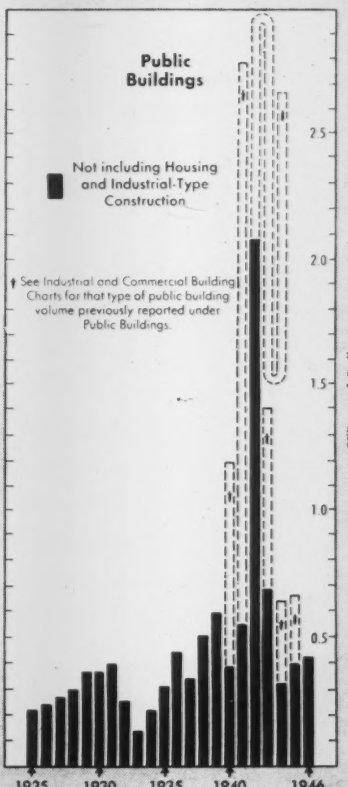


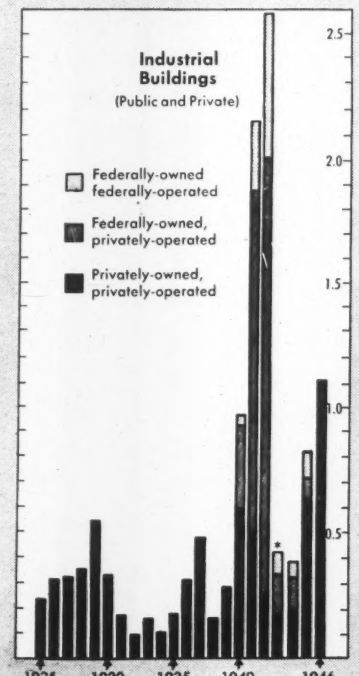




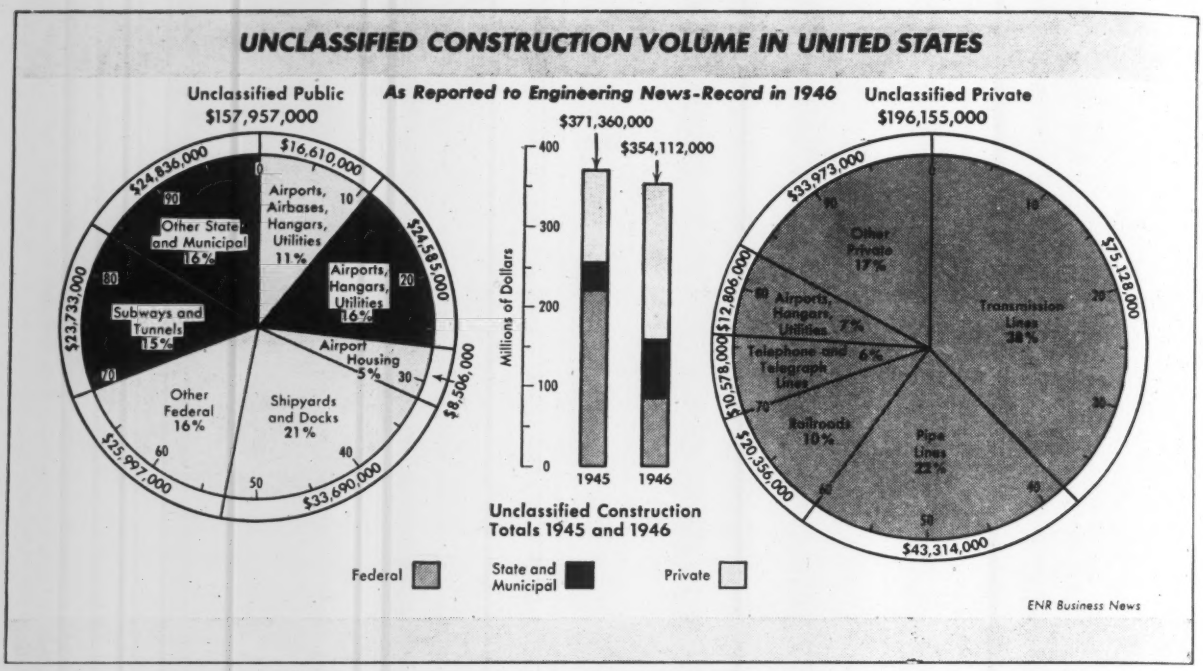








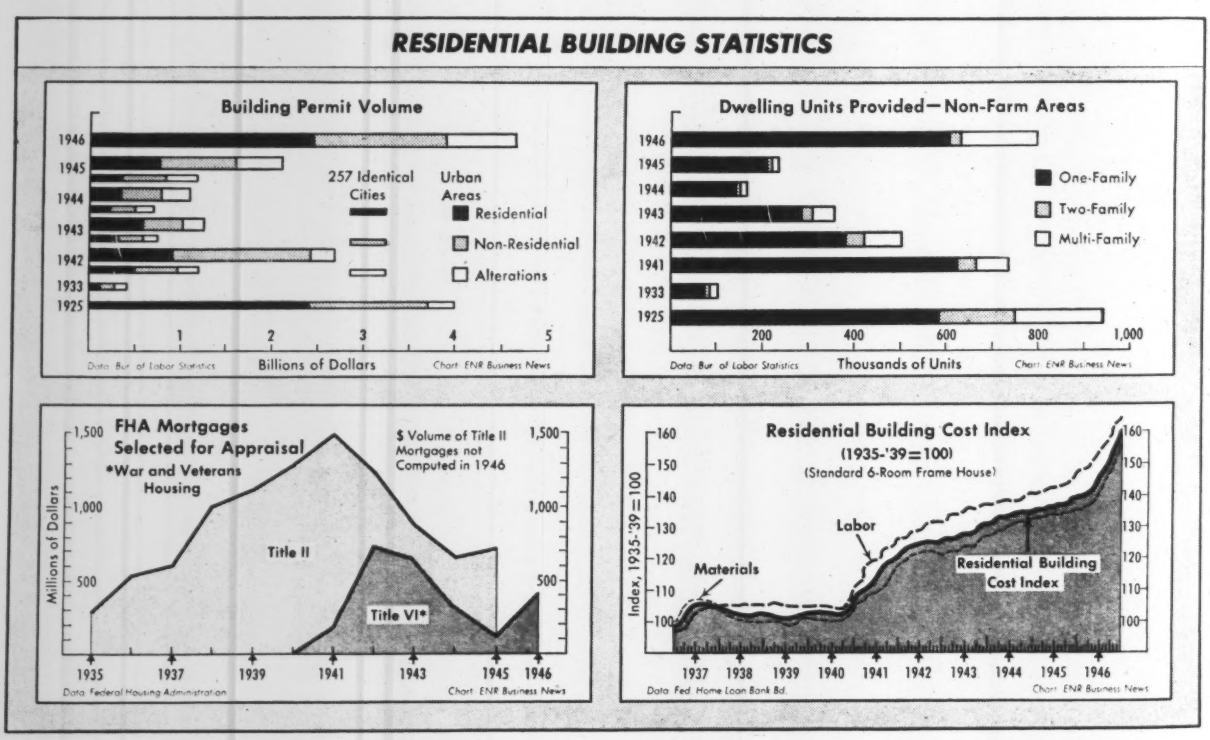
*Atomic Bomb Plants Included



percent; federal, 24 percent; and state and municipal, 21 percent. Unclassified private construction was for transmission lines, $75,128,000; pipe lines, $43,314,000; miscellaneous, $33,973,000; railroads, $20,356,000; airports, hangars and utilities, $12,806,000; and telephone and telegraph lines, $10,578,000. Federal unclassified construction is composed of shipyards and docks, $33,690,000; miscellaneous, $25,997,000; airports, hangars and utilities, $16,610,000; and airport housing, $8,506,068. State and municipal unclassified is: miscellaneous, $24,836,000; airports, hangars and utilities, $24,585,000; subways and tunnels, $23,733,000.

Commercial building was 36 percent of all construction in 1946. Industrial buildings followed as 22 percent; highways, 15 percent; public buildings, 8 percent; unclassified construction, 7 percent; earthwork, irrigation, and drainage, 6 percent; and waterworks, sewerage, and bridges, each 2 percent.

Geographically, all six sections reported gains over 1945 volume. New England, with a volume of $292,508,-



000, led the nation's gains with a 195 percent increase over 1945. Middle Atlantic volume of $1,228,326,000 followed with a gain of 186 percent; South, $864,146,000, with 182 percent; Far West, $1,116,866,000, a gain of 112 percent; West of Mississippi, $1,041,363,000, or a 109 percent gain; and the Middle West, $632,825,000, an increase of 47 percent over 1945.

For the first time since 1940, Middle Atlantic accounted for 24 percent of the nation's total engineering construction. Far West, high in 1945 with 23 percent dropped back in 1946 to 21 percent; West of the Mississippi, produced 20 percent; South, 17 percent; Middle West, 12 percent; and New England, 6 percent.

BUILDING PERMITS AND FINANCING

The Bureau of Labor Statistics estimate of total permit valuation of urban building construction for 1946 is $4,658,434,000, 119 percent greater than the $2,126,948,000 reported for 1945. Of the 1946 total, $2,441,773,000, or 53 percent, is for residential construction; $1,451,707,000, or 31 percent, for non-residential construction, and $764,954,000, or 16 percent, for additions, alterations, and repairs.

The number of dwelling units provided in 1946 totals 792,200, according to Bureau of Labor Statistics figures. This is 221 percent greater than the 246,500 units provided in 1945. (This rate of increase is lower than that for dollar volume reported elsewhere) Of the 1946 total, 85 percent, or 676,933 units, were privately financed while the remaining 115,267 units were federally financed. Private dwelling units are comprised of 604,562 one-family dwellings, 25,393 two-family dwellings, and 46,978 multi-family dwellings.

The value of Title VI FHA mortgages for which applications were received in 1946 is $401,679,582, or 247 percent greater than the 1945 figure of $115,608,000. These applications were comparatively low in 1945 because Title VI then covered war-housing, whereas it now insures veterans' emergency housing. The valuation of Title II applications was not computed in 1946.

V—NEW CONSTRUCTION CAPITAL

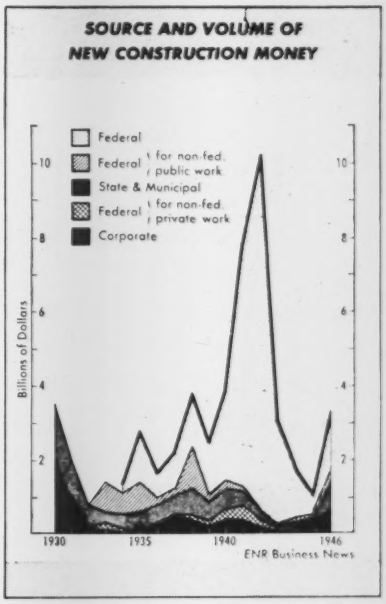
(Millions of Dollars)

	Corporate	State and Municipal	Federal	Total
1925	$1,966	$1,352	.....	$3,318
1926	1,824	1,344	.....	3,168
1927	1,784	1,475	.....	3,259
1928	1,568	1,379	.....	2,947
1929	1,758	1,418	.....	3,176
1930	2,032	1,434	.....	3,466
1931	787	1,235	.....	2,022
1932	159	561	.....	720
1933	292	1,091‡	.....	1,383
1934	77†	1,011‡	194	1,282
1935	47†	1,337‡	1,354	2,738
1936	251	698	691	1,640
1937	518†	738‡	946	2,202
1938	457†	1,902‡	1,345	3,704
1939	304†	783‡	1,318	2,405
1940	624†	805‡	2,466	3,895
1941	741†	477‡	6,677	7,895
1942	332†	225‡	9,662	10,219
1943	56†	135‡	2,882	3,073
1944	194†	193‡	1,327	1,714
1945	286†	409‡	1,129	1,824
1946	662	848	1,898	3,408

Note:—Federal appropriations include federal aid highway, WPA, and regular departmental appropriations for construction.

† Includes $237,000,000 RFC and PWA loans '33; $55,000,000, '34; $9,000,000, '35; $807,000, '37; $76,106,000 REA, $4,500,000 RFC loans, '38; $89,000,000 REA and $400,000 RFC loans, '39; $40,000,000 REA and $193,000,000 in RFC loans, '40; $100,500,000 in REA and $282,000,000 in RFC loans in '41; $149,800,000 in RFC in '42; $20,000,000 in REA and $14,030,000 in RFC in '43; $20,000,000 in REA and $61,440,000 in RFC loans in '44; $60,000,000 in REA and $24,400,000 in RFC loans in '45.

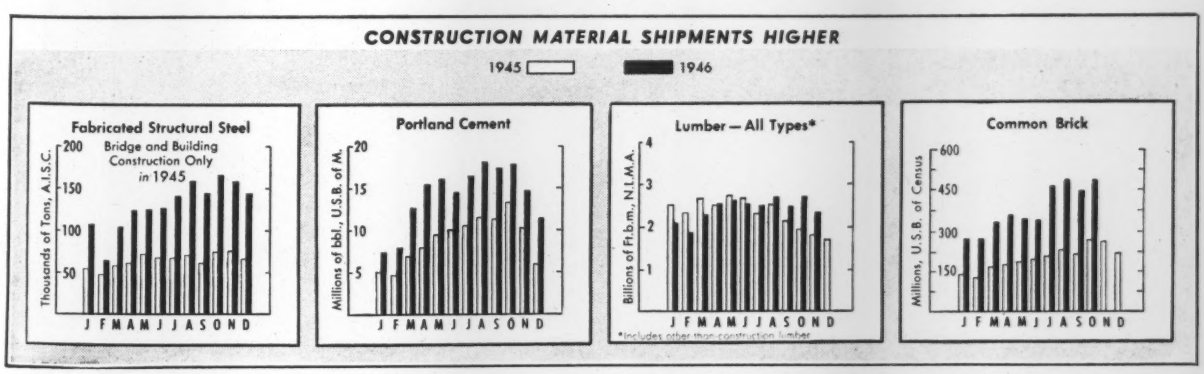
‡ Includes $814,000,000 RFC and PWA loans and grants '33; $580,000,000, '34; $808,000,000, '35; $164,700,000, '36; $207,000,000, '37; $723,265,000 PWA, $99,844,000 RFC, $320,986,000 USHA loans, '38; $216,000,000 in USHA loans, '39; $219,000,000 USHA, $5,000,000 RFC loans in '40; $30,000,000 in USHA, $6,900,000 in RFC loans in '41; $7,655,000 in RFC loans in '42; $3,133,000 in FPHA and $1,015,000 RFC loans in '43; $500,000 in RFC loans in '44; $200,000 in RFC loans in '45.



Residential building costs, reported by the National Housing Authority, rose 15 percent in 1946. The index rose from 139.7 in January to 160.8 in December. The material component part of the index rose 17 percent, while the labor component rose 11 percent.

NEW CONSTRUCTION CAPITAL

Capital made available for engineering construction in 1946 totalled $3,407,681,000, 87 percent greater than the 1945 new construction capital of $1,824,026,000. This new construction financing total for 1946 is made up of $661,558,000 in corporate security issues, $848,141,000 in state and municipal bond sales, $225,000,000 in federal-aid highway funds, and $1,672,982,000 in federal appropriations for military and departmental construction. Federal funds accounted for 56 percent of 1946 capital, com-



VI—OUTPUT OF VARIOUS CONSTRUCTION MATERIALS FOR TEN-YEAR PERIOD

Item	Basis	Unit	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946
Lumber	Shipments	Millions Bd. Ft	24,988	22,201	25,811	30,095	34,086	38,946	35,852	31 977	29,650	26,605(1)
Cement	Shipments	Thous. Bbl.	113,805	106,324	122,651	130,350	167,508	185,267†	127,632	94,272	106,398†*	169,336
Cement	Production	% Capacity	45.5	41.2	47.7†	51.2†	65.3†	74.0†	54.0†	31.9	43.0	68.0
Steel Ingots	Production	Thous. Net Tons	55,443	31,071	51,585	66,982	82,837	86,030	88,836	89,642	79,702	66,364
Steel Ingots	Production	% Capacity	72.4	39.7	64.7	82.1	97.3	96.8	98.1	95.5	83.5	72.2
Fabricated Structural Steel	Shipments	Thous. Tons	1,661	1,159	1,440	1,516	2,251	2,040	‡	‡	‡	1,552
Fabr. Str. Steel—Bridge & Bldg	Shipments	Thous. Tons	.....	.....	.....	.....	.....	1,678	832*	598*	797*	.....
Explosives	Shipments	Thous. lb.	387,805	320,259	372,470	406,671	460,075	427,744	451,773	447,100	440,208	470,625(1)
Brick	Shipments	Millions Brick	2,910	2,537	3,319	3,160	3,960	2,929	2,405	2,005	2,375	4,644

†*Includes Puerto Rico and Hawaii* from May through December. (1) Eleven months' total. ‡ A.I.S.C. estimated shipment data for entire industry discontinued.
* Approximately 80% of industry.

pared to 67 percent last year; state and municipal bond sales, 25 percent, compared to 22 percent; and corporate securities, 19 percent, compared to 11 percent in 1945.

MATERIAL SHIPMENTS

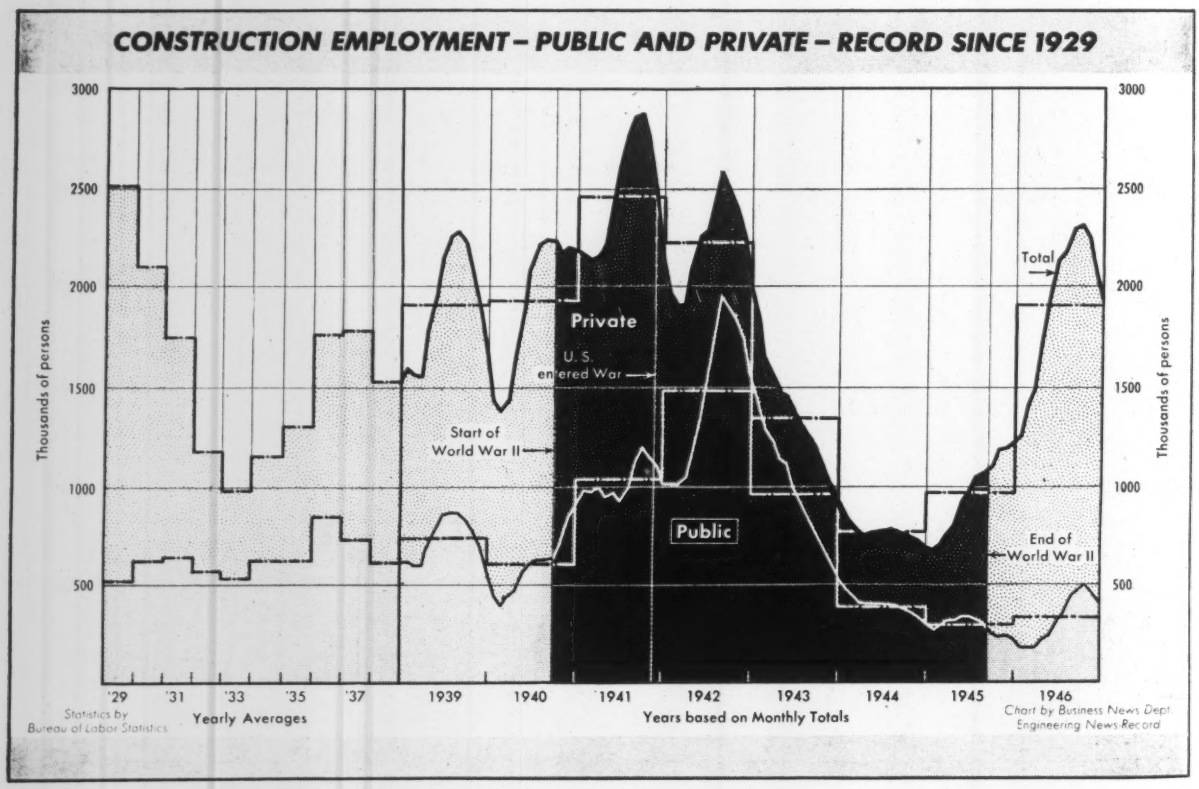
Although from the start of 1946 construction was plagued by severe shortages of construction materials, the situation had improved by the end of the year. Portland cement shipments, as reported by the Bureau of Mines, totaled 169,336,000 bbl., 59 percent greater than in 1945. A preliminary estimate by the National Lumber Manufacturers Association indicates that approximately 30,600 M ft. b.m. of lumber was shipped in 1946, 3 percent more than in 1945. Shipments of fabricated structural steel totaled 1,552,000 tons, estimated for the entire industry by the American Institute of Steel Construction. This tonnage is slightly over 1940 shipments, and a gain of 53 percent over comparable shipments for 1945. On the other hand, production of steel ingots was at 72.2 percent of capacity in 1946, compared to 83.5 percent in 1945. Shipments of brick reported by the Bureau of Census, in 1946 totaled 4,644,000,000, 96 percent greater than 1945 shipments.

EMPLOYMENT

Construction employment in the United States averaged 1,907,000 per month in 1946, 97 percent greater than in 1945, according to the Bureau of Labor Statistics estimates. Of this total, 1,583,000 persons or 83 percent were employed privately, 131 percent more than last year. During the first half of 1946, an average of 1,650,000 persons were employed on construction, compared with 2,165,000 in the last half. Employment in the last half of 1946 is close to the all-time high level of 2,508,000 persons in 1929.

CONSTRUCTION COSTS

The *Engineering News-Record* Construction Cost Index rose 12.3 percent in 1946 to 368.10, an all-time high (1913—100). The *Engineering News-Record* Building Cost Index rose 9.6 percent to 278.49, also an all-time high. Other indexes showed the following gains: American Appraisal, 18.8 percent; Associated General Contractors, 11.3 percent; E. H. Boeckh, 13.0 percent; Aberthaw, 18.2 percent; George A. Fuller, 20.3 percent: Turner Construction Co., 27.8

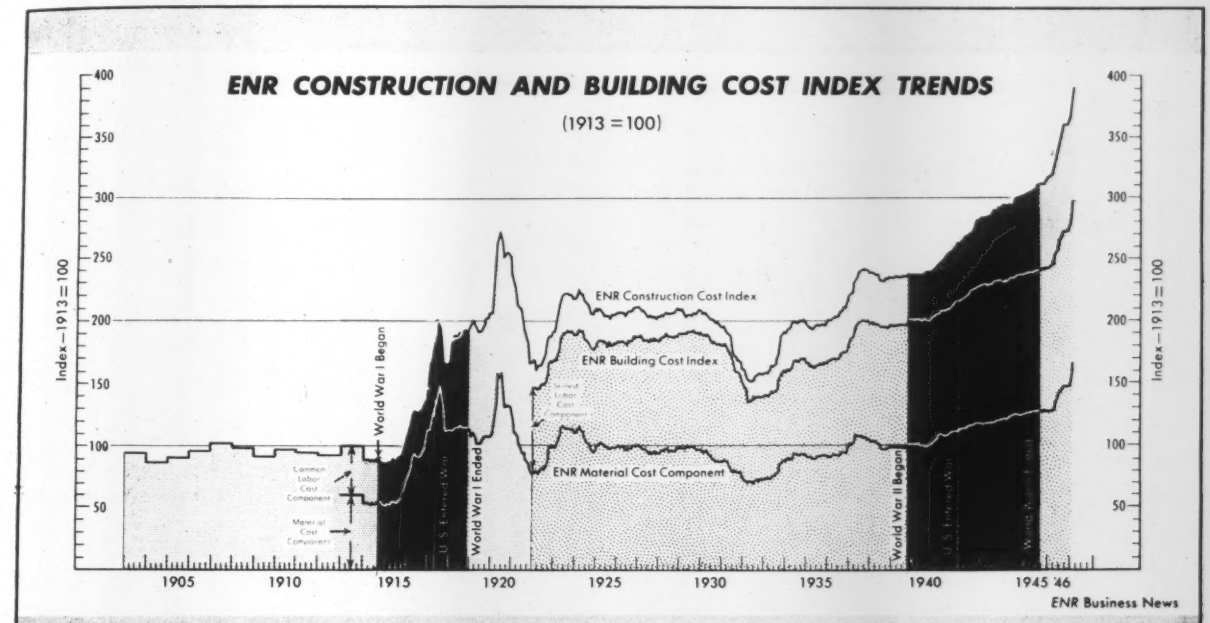


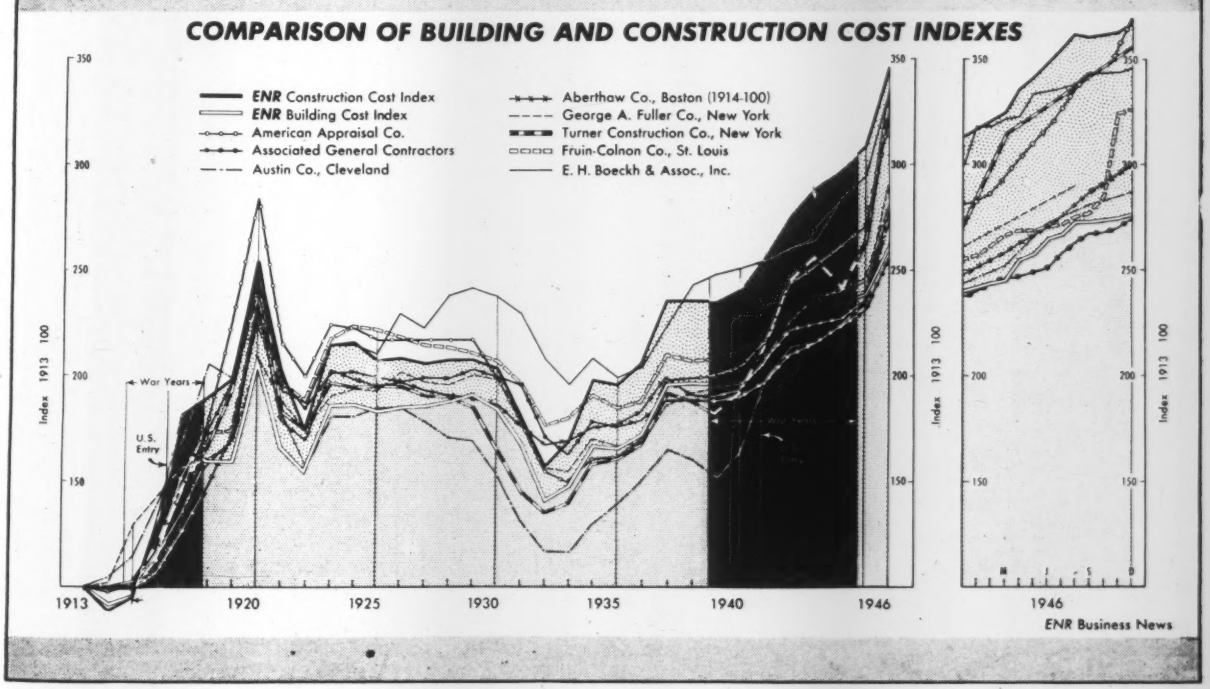
percent; Fruin-Colnan Co., 13.0 percent; and Austin Co., 16.7 percent. The weighted indexes, measuring price and wage rate trends, increased an average in 1946 of only 13.1 percent, compared to a gain of 19.2 percent in the contractor indexes, which reflect such cost factors as work stoppages, labor productivity, material shortages and overtime pay.

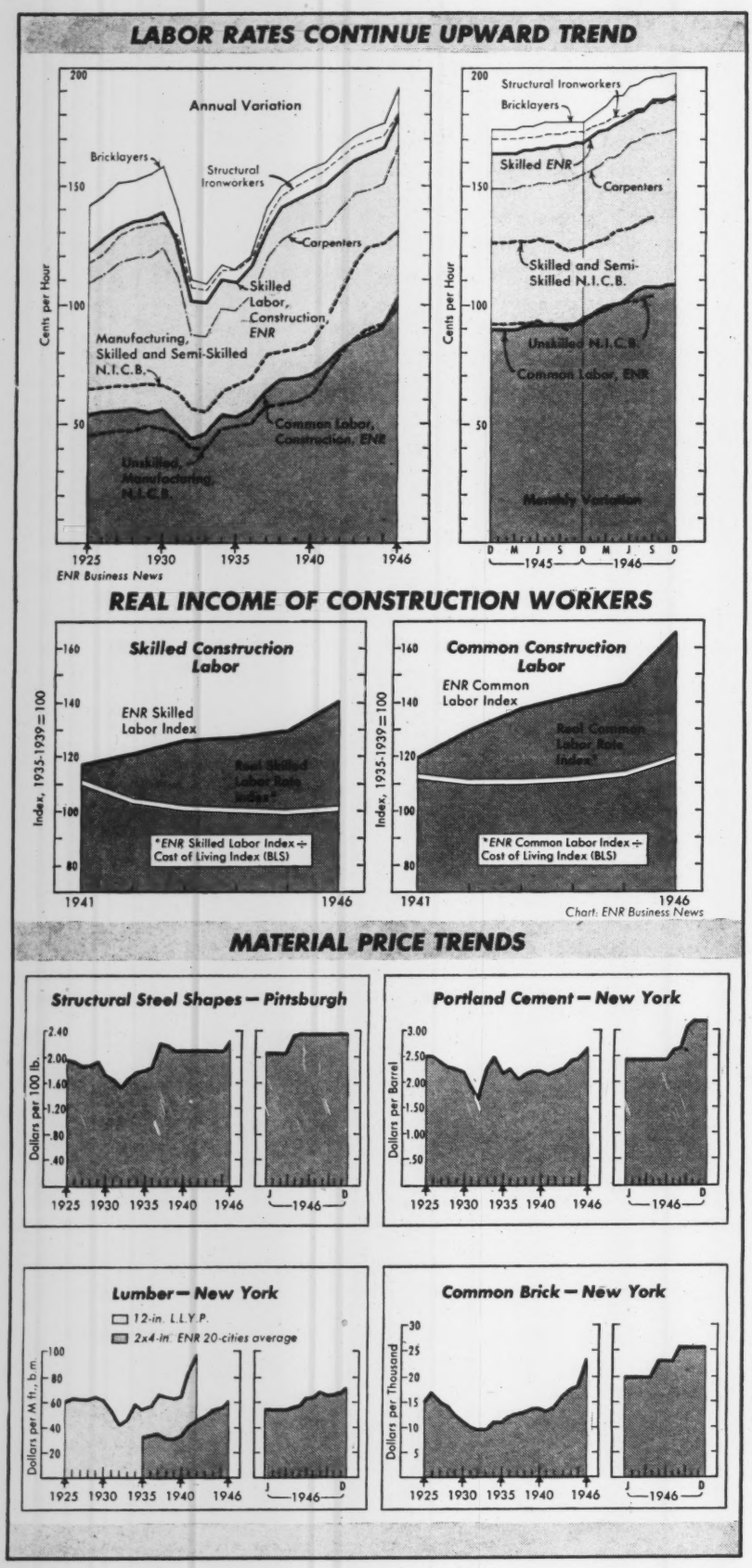
The rise in straight time wage rates and quoted material prices as measured by the *ENR* Construction and Building Cost Indexes leveled off from August through November, but took a sharp upward turn in December after removal of OPA controls. During the months of September, October, and November, the construction cost index averaged a monthly gain of only $\frac{1}{3}$ of one point, while the building cost index increased $\frac{2}{3}$ of one point per month. In December, however, the construction cost index jumped 6 points and the building cost index, 4 points.

LABOR RATES

Skilled construction wages rose 8.2 percent over the 1945 average to $1.80 per hour in 1946. Common labor wages rose 13.51 percent in the same period to a new high average







of $1.03 per hour. Skilled construction wages rose from $1.68 per hour in December, 1945 to $1.86 per hour in December, 1946, an increase of 10.8 percent, while common labor wages rose from $.938 to $1.085, an increase of 15.7 percent. Manufacturing wages, available from the National Industrial Conference Board for only nine months of 1946 at this writing, rose 10.5 percent for skilled and semi-skilled workers while skilled construction wages rose 10.1 percent. Unskilled manufacturing wages rose 12.6 percent in this period, and common construction wages, 14.3 percent.

Real income of skilled construction labor rose only 0.8 percent in 1946, while the real income of common labor rose 5.8 percent, with "real income" computed by dividing the *ENR* wage average by the BLS consumer price index.

MATERIAL PRICE RISES

Lumber again led the parade of price increases with its year's gain of 29.0 percent, a rise from $54.74 per M ft.b.m. in December, 1945 to $70.60 in December, 1946, according to the *ENR* 20-cities average of 2x4 lumber. Sand prices increased 22.3 percent, from the *ENR* 20-cities average of $1.25 to $1.53 per ton. The warehouse price of reinforcing steel, which includes freight charges, increased 20.3 percent, from $2.79 to $3.36 per cwt. Cement prices rose 15.1 percent, from $2.74 to $3.15 per bbl. Common brick rose 12.1 percent during the year, from $19.91 to $22.33 per M. The base mill price of structural steel increased 11.9 percent in 1946, a rise from $2.10 to $2.35 per cwt. Structural clay tile prices gained 10.6 percent, rising from $89.22 to $98.67 per M. The smallest rise recorded by the *ENR* 20-cities average was the gain of 10.5 percent in ready-mixed concrete prices which increased from $7.64 to $8.44 per cu.yd.

In the one month after removal of OPA controls on construction material prices, the greatest increase was again in the price of lumber. The *ENR* 20-cities average rose 5.8 percent from the November price of $66.71 to the December price of $70.60. Cement and ready-mixed concrete prices each rose 1.4 percent in this month, while other material prices showed changes of less than 1 percent.

Back to the Battle of Flood Control

Lieut. Gen. R. A. Wheeler
Chief of Engineers
U. S. Army

***Contents in Brief**—As 1947 gets underway the Corps of Engineers has in progress its greatest flood control program. Planning is well advanced for $450,000,000 of work, and the start of construction on 25 major dams, including the $158,000,000 Garrison Dam project and several structures, each to cost ultimately more than $20,000,000, is scheduled in 1947. In addition, construction of numerous large flood wall and local protection projects will be undertaken. Considerable rivers and harbors work will also go ahead.*

THE Corps of Engineers has returned to its peace-time functions and is now engaged in planning the greatest flood control and rivers and harbors program ever undertaken.

In the early years of the war the Corps with its decentralized organization met successfully the emergency needs for speedy completion of a military construction program of unprecedented magnitude. Later the achievements were repeated in the war theaters, typified by such operations as the crossing of the Rhine, the building of the Ledo Road, and the clearing and the rebuilding of Cherbourg and LeHavre harbors. Now once again these energies are devoted to peace-time tasks.

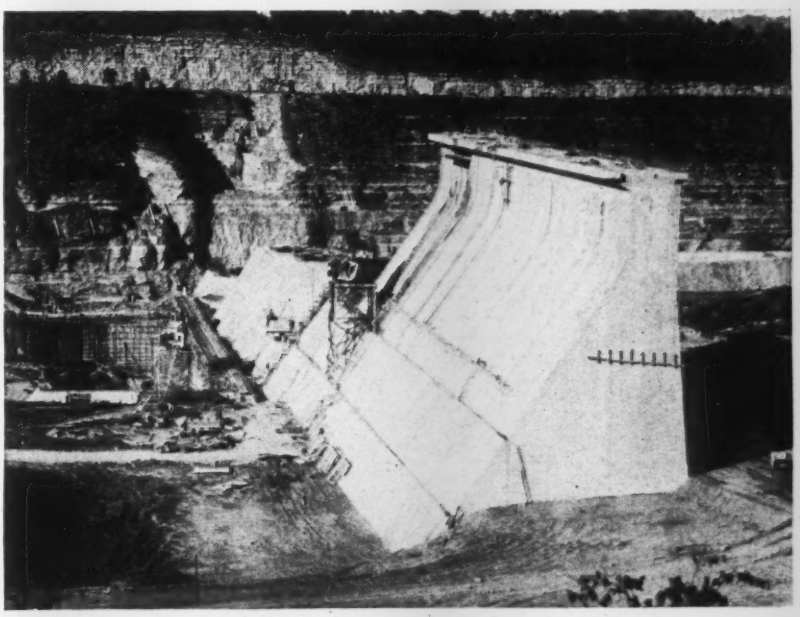
During prewar years private engineers and the Corps of Engineers had established mutually beneficial relations, as the policy of the Corps has always been that of utilizing outside able engineering talent and experience by doing almost all of its work by contract. When the war came upon us the contracting firms so engaged during times of peace contributed greatly to victory. Now as we resume the civil works activities the engineer-contractor-Army team, tried and proven in peace and war, opens the next big battle—that of flood control.

Good progress in the past

In June, 1946, the tenth birthday of the National Flood Control Program was celebrated. Notwithstanding the interruption of war years, the Corps of Engineers during the 10-year period prior to last June placed in operation some 50 reservoirs and 135 local protection projects. In addition, many other projects were in various stages of construction at the close of fiscal year 1946 or on June 30. Also, planning on authorized projects has proceeded to a point where it would be possible to expend over $450,000,000 during fiscal year 1948 on flood control projects if a large-scale public works program should be directed.

Among the more important projects or those expected to cost over $5,000,000 already under construction are: Union Village Dam in the Connecticut River basin; Almond Reservoir, which is a unit in the project for southern New York and Eastern Pennsylvania; Buggs Island Dam in Virginia on the Roanoke River; Clark Hill Dam in the Savannah River basin; and the Allatoona Reservoir in the Coosa River basin in Georgia.

Many projects are also going ahead on the tributaries of the Mississippi. These include: Local protection works along the Boeuf and Tensas Rivers and Bayou Macon in Arkansas and Louisiana; Narrows Dam on the Little Missouri River in Arkansas; and six big projects in the Arkansas basin, namely, Hulah, Ft. Gibson, Fall River, Wister and Canton dams, and local protection work at Ft. Smith, Ark. In the White River basin, Clearwater and Bull Shoals dams are



Interrupted by the war, the construction of Center Hill Dam on Caney Fork River in Tennessee has been resumed. This $33,000,000 flood control project calls for a dam 246 ft. high. Including a 778 ft. earth section the crest length is 2160 ft.

being constructed, as is Harlan County reservoir on the Republican River in Nebraska. Large Missouri Valley projects now under construction are: Cherry Creek Dam in Colorado, Kanopolis Dam on the Smoky Hill River in Kansas, Garrison and Ft. Randall dams on the main stem of the Missouri, and local protection works for the Kansas City area, and at Omaha, Council Bluffs and Kensler's Bend, Neb.

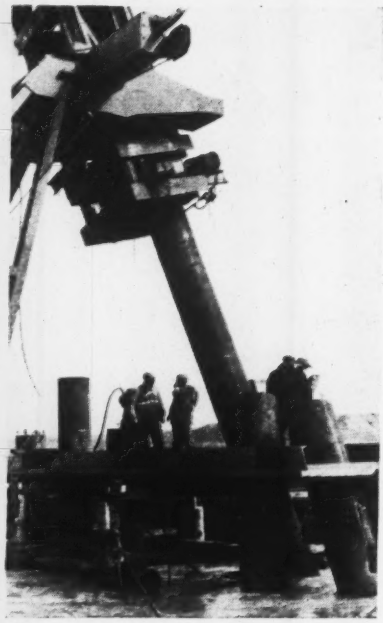
Numerous large jobs are also proceeding on the Ohio and its tributaries—including Dale Hollow and Center Hill dams in the Cumberland River Basin; Delaware Dam in Ohio, Dewey Dam in Kentucky, Conemaugh reservoir in Pennsylvania, Bluestone Dam in West Virginia, and local protection works at Cincinnati and Massillon, Ohio; Mound City, Ill.; Cannelton, Ind.; Newport, Ky.; Punxsutawney, Pa.; and at Parkersburg and Elkins, W. Va.

Much work is also underway in the West. This includes: Los Angeles River channel and Santa Fe Dam in the Los Angeles County drainage area, local protection for the Heise-Roberts area on the Snake River in Idaho; and Dorena Dam in Oregon in the Willamette River basin.

Reservoir projects costing $5,000,000 or more soon to be started include: Tully Dam in the Connecticut River basin; Mansfield Hollow Dam in the Thames basin; Hord's Creek Dam in the Colorado basin in Texas, and Whitney Dam on the Brazos River in Texas. Other large dams scheduled for an early start are: Tenkiller in Oklahoma on the Illinois River, Blakely Mountain in the Ouachita basin, Arkansas, Lookout Point in the Willamette basin in Oregon, Sutton on the Elk River in West Virginia, and Big Dry Creek in the San Joaquin basin. Local protection works soon to be placed under construction include those planned for Louisville, Ky.; Wood River, Ill.; Tacoma, Wash.; and completion of those partially built at Holyoke and Springdale, Mass.

Procedure on Lower Mississippi

Flood control work in the alluvial valley of the Mississippi River is carried out under special legislation. In accordance with the Flood Control Act of May 15, 1928, and supplemental legislation, construction has been planned to assure protection against all but the greatest predicted floods for the main stem of the Mississippi. The millions of acres subject to inundation by direct overflow of the Mississippi have enjoyed a record period of 20 years without experiencing direct overflow from that source. During this period numerous major flood-flows have been passed on to the Gulf of Mexico without a single failure in the main river controlling works. However, headwater floods in the tributary basins within the alluvial valley have been all too frequent, and the large back-water areas at the mouths of major tributaries have been inundated more or less every year.



Driving 24-in. steel pipe piles for the construction bridge over the Missouri River at Garrison Dam in North Dakota. The 75,000,000-cu. yd. dam will be by far the largest rolled fill in the world.

The legislation enacted subsequent to the original act in 1928, has expanded flood control of the Lower Mississippi River to include works for the protection of these tributary basins and for perfection of the main river works. During the war flood control and navigation work on the main stem proceeded due to its high importance to the war effort, but authorized works in the tributary basins and backwater areas had to be suspended. Detailed plans and specifications for a large amount of this latter work are now fully prepared and operations will proceed as rapidly as funds are made available by Congress.

Rivers and harbors work

The improvement of rivers and harbors for navigation as authorized by Congress is another important program of the Corps of Engineers, and this work embraces projects throughout the continental U. S., its territories and island possessions. It is generally recognized that water transportation is the cheapest medium for the movement of basic commodities, such as iron ore, coal and petroleum products. Shipping on the Great Lakes alone totals 118 billion ton-miles annually, and the inland waterways carry over 30 billion ton-miles of traffic yearly.

The benefits derived from the carefully planned program of waterway and harbor improvements is widespread. This program, which of necessity was interrupted by the war, can now proceed as speedily as appropriations for the work are made available by Congress. The projects range from small boat harbors of refuge to multiple-purpose dams, and major extensions of the inland and intracoastal waterway systems. They include such proposed and authorized improvements as the Tennessee-Tombigbee connecting waterway in the South, enlargement and extension of the Great Lakes connecting channels in the North, the huge multi-purpose McNary Dam project in the Northwest, and deepening of various seaports on the East, Gulf and West Coasts to accommodate the larger vessels now in general use.

Projects sufficiently planned and for which funds definitely are available to permit construction to start in 1947 include: McNary Dam; a waterway connecting Baltimore harbor and the Chesapeake and Delaware Canal; improvement of the Cape Fear River at Wilmington, N. C.; dredging of the St. Johns River to a greater depth as far as Jacksonville, Fla.; and improvement of the Savannah, Ga. harbor. Work can also be started on canalization of the Pearl River in Mississippi; construction of the Algiers Lock at New Orleans on the Gulf Waterway; construction of the Neches - Angelina multiple - purpose project in eastern Texas; extension

of the breakwater protecting the Crescent, Calif. harbor; and construction of a new international railroad bridge over the St. Mary's River to improve the approach to the locks at the Soo.

Innovations are planned

To carry out most effectively both the flood control and rivers and harbors programs special methods have been developed and much research work has been done by the Corps. To obtain more from the construction dollar and at the same time provide better structures, numerous changes over old construction practices are expected.

Because of the benefits to follow due to increased workability and durability, air-entraining cement will be used for most of the mass concrete dams now underway. Use of this type of cement is also expected to permit a reduction of the cement content and thereby reduce changes in the dimensions of the concrete during curing, which in turn will result in less cracking and thus reduce maintenance.

Considerable work will also be done to determine the benefits to be obtained from the use of the vacuum process in the placing of concrete. This method is believed to offer major benefits in obtaining a more dense concrete for ogee crests and conduits and around gates.

Big tainters to be used

Plans have also been completed to install 50x50-ft. tainter gates, the largest ever built, in constructing McNary Dam on the Columbia River. These gates will be of a new type greatly reducing steel requirements and at the same time eliminating maintenance difficulties of older designs. At Wolf Creek Dam some 50x37-ft. gates will be used, which will also exceed anything yet built.

On construction of earthfill dams concrete cutoff walls have been eliminated. The cutoff trenches are now made wider, carried to satisfactory foundation material, and then backfilled with a selected soil providing a highly impervious barrier.

The use of compaction equipment providing higher pressures will be extended on earthfill structures. A few years ago specifications required that the compaction equipment provide a pressure of 250 psi. For the work now to go ahead a pressure of 500 psi. is specified, and still higher intensities may be listed in a few years.

Much work has also been done to secure better slope protection for earthfill dams. The Corps is completing a study of between 75 and 100 earthfill dams, including both privately owned and government structures, to determine the best thickness, size and quality of stone for slope protection. This work includes special wave-tank studies at the Beach Erosion Board laboratories.

Another earth dam study relates to the effect of earthquake forces. Still another deals with more accurate determination of the pressures and forces acting on tunnels and conduits passing through earth dams. Work is also in progress to improve the design of relief wells for the toe of earthfills. In addition, the studies to provide better shear test procedures in studying clay soils have been extended.

Future construction of earth levees will be distinguished by methods providing denser embankments. Too frequently in the past the material for a levee was simply "piled up," which resulted in a porous structure of severe maintenance characteristics. With future work, although no attempt will be made to obtain the densities secured on earth dams, levee fills will be placed in layers of nominal thickness, and considerable compaction with the earthmoving equipment will be demanded. It is believed that better levees can be built with little, if any, increase in cost.

More attention will also be paid to the drainage of levees built to protect strictly agricultural areas. On the landside of these levees a trench 6 to 8 ft. deep or less, dependent on the height of the levee, will be constructed at the toe to concentrate any percolation and to provide better drainage of the levee itself.

For bank protection work on the Lower Mississippi a highly effective articulated concrete mattress that is cast on land and sunk in place was developed. It will be used extensively in the future. To make the work of using the mat still more economical a special placing rig has been designed by the marine division of the Corps and will be constructed at an early date.

Two far-reaching programs are already underway by the hydrology branch of the Corps. One study involves a comprehensive snow-melt investigation being carried out by the Army Engineers in cooperation with the U. S. Weather Bureau. To assist in the snow-melt studies a snow research laboratory has been estab-

For bank protection and stabilization of the navigation channel on the Missouri and Arkansas rivers, timber dikes have been used effectively. Here, near Pine Bluff, Ark., eleven long dikes were required in a distance of a few miles.

lished on a tributary of the Yuba River near Donner Summit, Calif., and another on a branch of the Flathead River near Marias Pass, Mont. The other comprehensive program of the hydrology branch calls for periodic (5 to 10 yr.) sedimentation surveys of all reservoirs built by the Army Engineers.

In cooperation with a federal interagency committee the Corps has done considerable work to develop a better silt sampler, and a greatly improved design has been obtained. The Army Engineers are also using supersonic echo-sounding devices for shallow-water hydrographic surveys, and a procedure whereby this equipment can be used to measure the depth of silt in large reservoirs is being developed.

As a joint venture with the Weather Bureau and other agencies much work is also scheduled to install automatically operating equipment for transmitting data from stations recording rainfall and runoff. The plan is to use high-frequency radio.

At the Waterways Experiment Station at Vicksburg pioneer work with hydraulic model studies continues to be done, and a huge model of the entire Mississippi basin is now under construction. This $3,000,000 model will cover nearly 200 acres and will be the world's largest. It will be used primarily to study coordinated operation of all reservoirs, existing or planned, in the Mississippi basin.

Late in 1946 a vacuum-tank testing apparatus of much greater size than older tanks was completed at the Waterways station to study models of the spillways and outlet works of proposed dams. The equipment is expected to be of great value in studying cavitation problems. At present a model of the proposed outlet works for Garrison Dam is being tested with the new equipment.

The Vicksburg station is also evaluating the effectiveness of a sheepsfoot roller creating the highest compaction pressure of any similar roller ever built. The roller has a 7-ft. dia. drum, legs 18 in. long and creates a foot pressure of 1,100 psi. Scheduled for an early start is another project to test a new pneumatic-tired roller of a design providing an intensive pressure and causing the roller to vibrate as it moves along. Also, the concrete laboratory of the Army Engineers, formerly located at Mt. Vernon, N. Y., has been moved to the Waterways station. All concrete research of a general nature will be concentrated at this laboratory.

In addition to the extensive hydraulic work at Vicksburg, important hydraulic studies are in progress at other laboratories. At the University of Iowa the design of the filling and emptying system for a lock 1,200 ft. long and of the type to be built both at New Cumberland Dam on the Ohio and at Keokuk Dam on the Mississippi is being tested. In the past, 600 ft. was the standard length for navigation locks, which frequently requires "double locking" with long tows.

At the University of Minnesota the St. Anthony Falls navigation project to extend the 9-ft. canalization of the Upper Mississippi upstream is being studied. This project calls for the construction of one new dam and two new locks.

The Bonneville hydraulics laboratory at Bonneville Dam on the Columbia River has been expanded and special studies are underway relating to the construction of McNary Dam. Tests are also scheduled with models of one of a series of navigation dams to be built on the Snake River, and of Lookout Point and Dorena to be constructed in the Willamette basin.

At Los Angeles the super-elevation of open channels where high velocities are encountered is under study. Two types of channels—rectangular and trapezoidal—are being investigated. The spiral easement in the bends of high-velocity channels is also under consideration.

Model of a model. This replica of the entire Mississippi River basin is being reproduced in a 200-acre outdoor model at Clinton, Miss., so that the effectiveness of coordinated operation of tributary reservoirs and main stem flood protection facilities can be studied. The white area corresponds to a 2½-acre outdoor model now in operation at the Vicksburg laboratory.

New dredges to be used

During the war the Corps built four diesel-electric sea-going hopper dredges of 700-cu. yd. capacity, which have much greater efficiency than older equipment. Now the Corps is constructing four 3,000 cu. yd. dredges of a new steam-electric design, each rig being powered by two 3,000-hp. electric motors.

In the design stage is an 8,000-yd. sea-going hopper unit, larger than any in the U. S. To be used for clearing the deepwater approaches to the New York harbor, the dredge is planned to replace three or four old antiquated units and is expected to permit much more economical work.

All of these improvements in techniques and equipment will produce major benefits for the flood control and rivers and harbors programs. Many of the improvements will also be of value to other public agencies and to private industry alike.

More Water Conservation for the West

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Assistant Commissioner, Bureau of Recalmation
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***Contents in Brief**—By letting over $109 million of contracts since V-J Day, the Bureau of Reclamation quickly got back on an active construction status. Design work had gone ahead so that a greater volume of work is ready for contract than in any year in history. Many projects, including Columbia Basin, Missouri Valley and Central Valley, will be scenes of 1947 operations.*

WITH the end of the war again making manpower and materials available for peacetime pursuits, the Bureau of Reclamation in 1946 accelerated its planning and construction activities to a high velocity, looking toward the earliest possible realization of benefits from the development of the land, water, and related resources of the 17 western states. Until the projects now under construction are completed repayments to the Treasury cannot begin, and the nation will not receive the full benefits of these wealth-creating, tax-producing undertakings. In 1947 the bureau is ready to advance these programs to completion—just as rapidly as conditions permit.

That definite progress has been made is attested by the fact that during July, August and September of 1945 only $2,131,000 in construction contracts were awarded, whereas after V-J Day the construction program was stepped up to the extent that the total awards for the year ended June 30, 1946, amounted to $109,234,000.

For the calendar year the total was $158,000,000. In its construction work the bureau met the same problems of shortages and increased costs that confronted the entire construction industry. Performance clauses in some contracts necessarily were extended, and a number of bids were rejected as being too high. But by redesign of some structures and the effective use of substitute materials, many of the obstacles of prevailing economic conditions were overcome. However, construction of transmission lines and installation of some electrical equipment were seriously affected by shortages.

The forward momentum achieved in 1946 is being carried through into this year by contracts now in effect, and new work scheduled will add to the force of the construction program. Although intensified design activity has brought to the construction stage a dollar volume of work unequalled in the 44-year history of federal reclamation, the rate of construction progress on the larger projects is being retarded because of inadequate funds.

The foundation for the bureau's expanded activity was laid fully a decade ago when study of entire river basins was initiated. Detailed investigations of such great rivers as the Missouri, Columbia, and Colorado and of California's Central Valley, then begun, have evolved into plans for comprehensive development. Unforeseen possibilities of coordinated irrigation, flood control, and power development were disclosed by the investigations, and correspondingly the plans that have been worked out envisage work serving these uses in effective combination and opening up a vast industrial growth to match the agricultural expansion to be created by the development.

An impelling force back of the year's reclamation development was the urgent demand for veterans' settlement opportunities, and there was recorded the first opening of lands for World War II veterans when ex-service men drew for 86 farm units comprising 7,500 acres of the rich land of the Tule Lake area of the Klamath project in California. More than

Sacramento River water behind Shasta Dam in California, which upon completion of the Delta pumping system will be available for San Joaquin valley irrigation several hundred miles south.

2,000 veterans had filed applications. The scheduled opening in 1947 of approximately 29,920 acres of public lands of the Yakima (Washington), Shoshone (Wyoming), Minidoka (Idaho), Gila (Arizona), and Yuma (Arizona) reclamation projects has been made possible by development work accomplished last year.

First irrigation water was delivered to a 50,000-acre development on the Deschutes project in Oregon and to a part of the 60,000 acres that will be supplied by the Altus project in Oklahoma.

Accomplishments and plans

Missouri Basin—On the largest of the basin-wide developments—that of the Missouri Valley—the year 1946 signalized the transition from the planning stage into construction of units that will be a part of the project to bring irrigation to five million acres of land and related benefits to a large area. Missouri basin construction was touched off May 15, when preliminary excavation was begun for Kortes Dam and power plant, which will stabilize the production of power on the upper North Platte River in Wyoming. This year the diversion tunnel will be driven and placement of the 150,000 cu.yd. of concrete in the dam will be begun.

Start of work on Angostura Dam, which will provide an irrigation supply for 16,000 acres from the Cheyenne River in South Dakota, was the next step in the Missouri basin. This was followed by the award of a contract for construction of Enders Dam, a 1,750,000-cu.yd. earthfill structure —key feature of the big Frenchman-Cambridge unit—designed to store and regulate the waters of the capricious Republican River in Nebraska. In 1947 this activity will be expanded to include diversion dams and construction of the 30-mile Cambridge-Oxford canal.

At the Boysen Dam site on the Big Horn River in Wyoming, relocation of 4½ miles of U. S. Highway 20 got under way as a preliminary to construction in 1947 of the dam which, with its 15,000-kw. power plant is to be a key source of power for the Wyoming-Montana area and stabilize irrigation supplies for a large acreage on the lower Big Horn.

Elsewhere in the Missouri basin in 1947, canals on the Riverton and Shoshone projects in Wyoming will be extended, and installation of pumping units will make possible further use of waters of the Yellowstone River in Montana.

Columbia Basin—The million-acre Columbia basin project (*ENR* May 16, 1946 vol. p.780) was the scene of growing activity during the year as the construction of the irrigation features was begun on a wide front to make possible the development of the rich lands of the basin by utilizing water stored by Grand Coulee Dam. Contracts were awarded for South Coulee, Long Lake, and Potholes dams, units of the distribution system. These are earthfill structures with a combined volume of twelve million cubic yards.

Construction is already in active progress on South Coulee Dam, which will form one of the two barriers in the ancient Grand Coulee to create a 27-mile-long equalizing reservoir. In 1947, embankment placement in Long Lake and Potholes dams also will be pushed actively.

Work started, in addition, on three huge river-size canals, the Main, West, and East Low canals; these contracts cover 33 miles of the ultimate 500-mile system of canals and laterals. Orders were placed for six pumps of the ultimate installation of twelve 1,600,-cfs. capacity units that will lift the water from Grand Coulee's reservoir up into the basin. The pumps will be driven by direct-connected 65,000-hp. motors. To make possible the early delivery of water to the southern end of the project, work was pushed on the Pasco pumping plant and laterals, which will deliver water to about 6,000 acres of land. In addition to the irrigation system, six million dollars in contracts were awarded for

Excavating the river-size Main Canal of the Columbia Basin project in Washington through which water from Grand Coulee reservoir, pump-fed from the Columbia River, will be distributed to a million acres of new farmland.

the improvement of or addition to the facilities of the Grand Coulee power plant.

Items scheduled to be put under contract in 1947 include the Soap Lake siphon, Main and West Canal laterals, and the Burbank pumping plant No. 1. However, because of inadequate funds the bureau will not be able to achieve its original goal of placing 400,000 acres under irrigation by 1951.

Central Valley—With Shasta, Keswick, and Friant dams virtually complete, work in California's 500-mile-long Central Valley was directed toward carrying the stored water to the irrigated lands of this major food producing area. Contracts for 73 miles of the big Friant-Kern canal were pushing this 156-mile artery from Friant Dam toward the southern end of the project. During 1947, twenty-one miles of this work is scheduled for completion and an additional 47 miles to be let.

Also 24 miles of the Delta-Mendota Canal, which will carry Sacramento River water up the San Joaquin valley to replace that diverted by the Friant-Kern Canal, were placed under contract in 1946, while this year the Delta-Mendota pumping plant, the manufacture of six 767-cfs. pumps for it and of other pumps for the Delta Cross Channel are expected to get under way. Among other items of progress on the Central Valley project were the advancement of the Contra Costa Canal and the beginning of work on the Ygnacio and Clayton pumping plants.

The two 75,000-kva. generators loaned to Grand Coulee during the war will be installed at Shasta power plant in 1947. The fifth and final 75,000-kva. generator will be installed by 1948. Transmission lines will be constructed to take the power to load centers and to interconnect with Keswick power plant which will also be completed in 1948.

Colorado River—On the Colorado, one of the final steps in the development of the lower section of the river was begun when construction started at Davis Dam and power plant, which will complete essentially the utilization of the Colorado from Boulder Dam to the Mexican border. Davis Dam work probably will reach its peak this year when a substantial portion of the 4,000,000-cu. yd. earthfill as well as the concrete spillway will be completed. Distribution of Colorado River water to irrigate desert lands was advanced by completion of an 11-mile section of the 145-mile long Coachella Canal, making a total of 98 miles of the canal excavation essentially completed. Substantial progress was made on two other sections amounting to 18 miles.

Concrete lining operations on the Coachella branch of the All-American Canal in Southern California. About 100 miles of the 145-mile branch is now complete.

Colorado-Big Thompson — Progress on this transmountain diversion project was emphasized by the completion of Shadow Mountain Dam, placing of final concrete lining in the 13-mile Continental Divide tunnel, and by the initiation of work on a number of other features. Granby Dam, on the western slope, and eastern slope features, including tunnels and conduits and the 147,000-acre-ft. Horsetooth reservoir, were put under construction. Expansion of this work in 1947 will take in the Granby pumping plant on the western slope and two power plants, Estes and Marys Lake, with respective generating capacities of 45,000 and 8,100 kw., on the eastern slope of the Continental Divide. The Rams Horn and Prospect Mountain tunnels, with a combined length of 2.3 miles, leading to these power plants will be well advanced. The hundred-million dollar Colorado-Big Thompson project will provide supplemental irrigation to an agricultural area of 615,000 acres, and furnish a block of power to the industrial area east of the Rocky Mountains.

Other Reclamation projects—The largest concrete dam in the immediate program will be Hungry Horse Dam. Plans under consideration call for a structure approximately 450 ft. high. The dam, located on the South Fork of the Flathead River, will be the first step in providing irrigation water for about 100,000 acres of undeveloped land near Kalispell, Mont. It will generate a large block of power and provide regulation of the Columbia to increase the firm power production at Grand Coulee and Bonneville.

Anderson Ranch Dam, on the South Fork of the Boise River, 444 ft. in height, neared completion, leaving only 360,000 cu.yd. of material to be placed in the 9,000,000 cu.yd. embankment. Appurtenant features, including the power plant, will be the scene of 1947 activity. Cascade Dam, on the North Fork of the Payette River, to store 700,000 acre-ft., was started, as were irrigation facilities for the development of 25,000 acres of new lands in southwest Idaho.

Supplemental supply of domestic water for Salt Lake City and its suburbs was brought nearer to realization by completion of a 10-mile concrete pipe section of the Salt Lake aqueduct and good progress on other sections. In 1947, work is scheduled to be resumed on the 6-mile Duchesne tunnel and continued work on the Provo River Canal, including the Jordan Narrow siphon and power plant, and the Salt Lake aqueduct will advance the Provo River

project development to the final stages. And in south-central Washington further development of the Yakima project was begun by starting work on pumping plants that will lift water to irrigate an additional 25,000 acres of new land above the Roza Canal.

Extension of irrigation distribution facilities will characterize a large volume of construction on the Tucumcari project, New Mexico; Altus, Oklahoma; Mirage Flats, Nebraska; Kendrick, Wyoming; and Balmorhea, Texas.

Construction of transmission lines, an activity that was seriously delayed by materials shortages in 1946, will be pushed to alleviate serious power shortages in the West.

Research developments

In 1946, the broad test program already in progress was continued and a number of major research projects were added. Among them is an extensive field and laboratory study of canal linings with a special view to low-cost construction to control seepage (*ENR* Feb. 6, vol. p.192). Weed control is the subject of another large scale undertaking. Broadest of all is an investigation of riverflow and sediment transportation that promises to engage the best abilities of the bureau's research staff for years to come.

One of the important conclusions resulting from joint research and field experience is that entrained air in concrete greatly improves its durability and volume constancy. Research has also made marked progress in the study of the mysterious aggregate-alkali disintegration of concrete by discovering that osmotic pressure is the direct cause of the observed cracking. In recognition of the growing importance of research, the bureau's laboratories have been given increased space and better facilities in new quarters in the former Denver Ordnance Plant. Adjoining these quarters, hydraulic model experimentation will be initiated on a larger scale than formerly.

At the present time the bureau is making investigations and preparing comprehensive reports on many river basins, to evolve the best plan for the maximum utilization of the water resources of the seventeen western states for irrigation, power production, fish and wildlife propagation, domestic and industrial uses, recreation, silt and flood control, and assistance to navigation. All governmental agencies—local, state, and national—that have an interest in the development of the water resources in the affected areas are participating in these studies.

Ready to backfill a 10-mile concrete pipe section of the Provo River aqueduct that will provide Salt Lake City with a new water supply.

The first report on a plan for comprehensive river development was on the Missouri River basin. This was submitted to the Congress in 1944 and was printed as Senate Document 191, 78th Congress. A plan of the Corps of Engineers relating particularly to navigation and flood control was coordinated in Senate Document 247, 78th Congress, with the plan of the Bureau of Reclamation. The unified plan of development for the Missouri River basin as adopted by the Congress, provides for the irrigation of some 4,760,000 acres of new land and for supplemental irrigation for about 540,000 acres now inadequately irrigated because of water shortages. In addition, the plan includes provisions for installation of about 1.9 million kilowatts of hydroelectric power, which will produce about 5.5 billion kilowatt-hours of firm electric energy each year when all installations are complete. This is about equal to present total power installations in the Missouri River basin, exclusive of power in Kansas and Missouri. In addition, municipal water supply, flood control, navigation, and other benefits will result from this unified plan of development.

Other basin reports have been prepared in preliminary form. At the present time, the Secretary of the Interior has approved two such basin reports which are either in process of review by the affected states and other governmental departments in accordance with provisions of the Flood Control Act of Dec. 22, 1944, or which have been reviewed and are being given final consideration before being submitted to the Congress by the Secretary of the Interior.

This group includes reports on: Colorado River basin in the seven States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming, which describes 134 potential multiple-purpose projects, from which a selection of projects may be made for the ultimate development of the basin; and the Central Valley basin, California, which presents a plan for the ultimate irrigation of 3,040,000 acres of new land and supplemental irrigation of 2,400,000 acres of land now inadequately supplied from surface and groundwater supplies, the development of substantial amounts of electric power, and other important services.

Comprehensive reports on the development of water resources of twenty additional river basins are now in the process of review within the Department of the Interior, or are under course of preparation in the several regional offices of the Bureau.

Much more irrigation possible

This program of investigation will continue for many years. It now appears that the ultimate development of western water resources may make possible the irrigation of twice the present irrigated area, including all private and federal irrigated lands. With the hydroelectric power and other multiple-purpose services created, it will also make possible an industrial development and expansion that will contribute much towards continued national economic welfare and unity. The East, as well as the West, will benefit from these wealth-creating and tax-producing reclamation programs which are reimbursable to the federal Treasury under reclamation laws.

Airports—A New National Investment

***Contents in Brief**—Civilian airport construction, involving expenditures of a billion dollars, half provided by the federal government over a period of seven years, is soon to be started. Funds have already been allocated for over $70,000,000 of work this year to improve about 400 existing fields and to construct an equal number of new fields. The complete program contemplates construction or improvement of over 4,400 airports of five general classes.*

WITHIN A FEW WEEKS actual construction will begin on a seven year, $1 billion national airport program under supervision of the Civil Aeronautics Administration. This work, which launches the greatest peace-time airport program ever undertaken by any country, inaugurates also a new national investment from which large dividends are expected. Authorized by the last Congress on May 13, 1946, when it passed Public Law 377 or the Federal Airport Act of 1946, the big undertaking will be aided by $500,000,000 of federal funds on a matching basis with local governments. The maximum amount of federal funds that can be appropriated in any one year for construction is set at $100,000,000.

Great need for the new facilities is indicated by the tremendous growth in U. S. aviation in recent years. To cite only one measure of this growth the number of registered American aircraft more than doubled during the last year to a total of 85,000 at the end of 1946, while the CAA estimates that this figure will increase to 400,000 by 1955. To meet the varied and rapidly expanding needs for airports that this number of planes will create the CAA plans to assist in constructing five classes of fields. Class 1, the smallest would be what is known popularly as the "airpark." It is planned for the small privately owned plane weighing up to 4,000 lb. gross. This field would only be suitable for small communities or as an auxiliary to fields for larger communities. Paved runways would not be required. Instead, turf landing strips with clear approaches, an overall width of 300 ft. and a length of 1,800 to 2,700 ft. are specified.

The Class 2 airport is planned to accommodate larger private aircraft or those weighing from 4,000 to 15,000 lb. At least one paved runway 150 ft. wide and 2,500 to 3,500 ft. long is listed as desirable for this type of field.

Class 3 terminals are expected to be built on feeder-line airways or in the smaller communities on the main lines. Such ports would accommodate planes up to 50,000-lb. gross weight, and paved runways measuring 200 ft. wide and 3,500 to 4,500 ft. long would be required.

Planned to serve the major industrial centers, Class 4 and 5 airports will be built to accommodate the largest planes planned for the immediate future or those weighing 74,000 lb. and over. Runway widths will need to be at least 200 ft., and the lengths 4,500 ft. or over for Class 4 projects and 5,500 ft. for Class 5 terminals. Major industrial cities are also expected to generate a need for several smaller airports in addition to the large terminal.

It is to be noted that the runway lengths listed are the basic sea level lengths. In general, the listed lengths would need to be increased by 25 ft. for every 100 ft. of elevation above sea level.

Construction fund available

As passed, the Airport Act provided no money for construction. However, its enactment was followed a short time later by passage of an appropriation bill that provided $45,000,000 of federal aid for the fiscal year 1947, which ends next June 30. In accordance with the distribution rules set up in the original act $1,740,000 was earmarked for work in

At Class 4 and 5 airports the largest planes in use will be accommodated on runways at least 4,500 ft. long and 200 ft. wide. This model was built to illustrate one possible layout for a large terminal.

TABLE 1—FUND ALLOCATIONS FOR AIRPORT WORK SOON TO BE STARTED

State	No. of Projects	Federal Share	Sponsor Share	Total
Alabama	0	0	0	0
Arizona	10	$431,869	$286,728	$718,657
Arkansas	17	512,806	680,834	1,193,640
California	33	902,966	1,046,721	1,949,687
Colorado	8	410,671	380,658	791,329
Connecticut	5	308,995	335,195	644,190
Delaware	1	52,050	64,250	116,300
Dist. of Columbia	0	0	0	0
Florida	15	504,895	517,800	1,022,695
Georgia	17	692,245	749,228	1,441,473
Idaho	45	991,281	847,966	1,839,247
Illinois	10	1,427,243	1,615,143	3,042,386
Indiana	15	562,601	663,351	1,225,952
Iowa	18	481,127	574,667	1,055,794
Kansas	35	1,260,660	1,434,450	2,695,110
Kentucky	13	606,023	920,823	1,526,846
Louisiana	14	586,369	721,496	1,307,865
Maine	4	262,292	269,293	531,585
Maryland	7	313,250	352,550	665,800
Massachusetts	15	707,678	827,511	1,535,189
Michigan	30	1,354,227	1,521,746	2,875,973
Minnesota	41	982,550	1,275,480	2,258,030
Mississippi	10	475,781	497,912	973,693
Missouri	32	1,360,289	1,533,465	2,893,754
Montana	46	797,322	743,638	1,540,960
Nebraska	9	163,902	228,206	392,108
Nevada	1	45,110	30,666	75,776
New Hampshire	13	162,795	184,335	347,130
New Jersey	7	618,183	997,308	1,615,490
New Mexico	10	748,883	595,969	1,344,852
New York	7	2,139,325	2,155,075	4,294,400
North Carolina	10	1,048,717	1,118,717	2,167,434
North Dakota	20	243,243	297,103	540,346
Ohio	5	696,040	748,454	1,444,494
Oklahoma	23	752,201	899,570	1,651,771
Oregon	32	609,826	623,174	1,233,000
Pennsylvania	27	1,888,785	1,922,886	3,811,672
Rhode Island	2	114,750	124,750	239,500
South Carolina	3	103,000	107,500	210,500
South Dakota	19	647,136	616,223	1,263,359
Tennessee	14	436,790	530,171	966,961
Texas	70	2,237,831	2,739,129	4,976,960
Utah	17	745,090	484,590	1,229,680
Vermont	5	103,800	140,475	244,275
Virginia	8	675,000	712,500	1,387,500
Washington	16	717,416	842,884	1,560,300
West Virginia	3	677,055	677,055	1,354,110
Wisconsin	25	1,676,560	2,432,586	4,109,146
Wyoming	3	177,630	135,070	312,700
Total	790	$33,414,258	$37,205,361	$70,619,619
Territory:				
Alaska	4	$178,825	$67,975	$246,800
Hawaii	5	413,250	477,250	890,500
Puerto Rico	0	0	0	0
Total	9	$592,075	$545,225	$1,137,300

the territories and 5 percent of the balance or $2,163,000 was designated for administrative purposes. Of the remainder 25 percent or $10,274,250 was set aside as a discretionary fund to be used by the CAA administrator regardless of state boundaries. This left the other 75 percent, or $30,822,750, for distribution to the states, one-half on a basis of population and one-half on a basis of area.

Early in January of this year the CAA announced the allocation of $26,723,409 from the state fund, $6,690,849 from the discretionary fund, and $592,075 of the money listed for the territories. When combined with local matching funds the federal aid will permit a $71,756,919 construction program. Due to the way the Airport Act is written the first year's construction is limited to work on Class 1, 2 and 3 fields.

A breakdown of where the money will be spent is shown in Table 1, In all, work is planned on 799 airports this year. Entirely new fields to be built consist of 230 Class 1 airports, 109 Class 2 fields, 44 of Class 3 size, and three seaplane bases. Projects for improvement of existing airports call for work at 83 Class 1 fields, 179 of the second class, and 151 of Class 3. Other projects will be added since all of the federal funds have not been allocated.

The regulations under which the aid money is allocated vary. On Class 1, 2 and 3 airports the money put up by the sponsor is matched dollar for dollar by the CAA. For larger fields the local sponsor's money is also matched on a 50-50 basis for construction costing up to $5,000,000, but the federal share then decreases by 5 percent for each additional $1,000,000 up to $11,000,000 when it becomes a straight 20 percent of each added $1,000,000. Under this formula for a $5,000,000 airport the federal share would be $2,500,000, for an $11,000,000 job the federal funds are $4,450,000, and for a $12,000,000 project a total of $4,650,000 of federal aid could be provided. However, in securing land for airfields the CAA will provide only 25 percent of the cost and no assistance in the building of hangars, although the federal government will aid in constructing administration buildings.

Two exceptions occur to the above rules. In Alaska, a maximum of 75 percent of the total cost may be paid from federal money, and in states where public lands exceed five percent of the state's area, a maximum of 62.5 percent of the total project cost may be met with federal funds.

Future work outlined

The act under which the work is being done also specifies that the CAA administrator shall forward to Congress each year a revised national airport plan. Early in February of this year the CAA announced the 1947 national airport plan outlining the need for improvement or construction of 4,431 airports, including the 799 projects already mentioned.

Total cost of the revised national program is placed at $985,800,000, of which the federal government would supply $441,600,000 and local sponsors $544,200,000. By types of fields the program is made up as follows: Class 1, $158,500,000; Class 2, $196,500,000; Class 3, $193,800,000; Class 4 and above, $435,000,000, and seaplane airports, $2,000,000.

The proposal is to provide 2,215 Class 1 fields of which 1,708 would

TABLE 2—FOR AIRPORT PLANNERS

Title	Cost per copy
Airport Planning for Urban Areas	20 cents
Small Airports	10 cents
Airport Drainage	30 cents
Airport Buildings	20 cents
Airport Design	15 cents
Airport Lighting	15 cents
Pavements Design Class 1 and 2 Airports	free
Pavements Design Class 3, 4 and 5 Airports	free

Publications for which there is a charge may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D.C. Stamps will not be accepted. The design manuals may be obtained from the regional and district offices of the CAA.

TABLE 3—1947 NATIONAL AIRPORT PLAN WITH ESTIMATES COST OF PROJECTS PLANNED FOR EACH STATE

State	Number of Airports			Estimated Cost (Millions of Dollars)		
	Total	New	To be improved	Total	New	To be improved
Alabama	83	50	33	$12.1	$6.9	$5.2
Arizona	40	16	24	11.4	2.7	8.7
Arkansas	73	48	25	11.8	4.3	7.5
California	183	72	111	67.9	14.0	53.9
Colorado	103	45	58	10.3	2.2	8.1
Connecticut	14	7	7	5.4	2.5	2.9
Delaware	11	7	4	1.8	0.7	1.1
Dist. of Columbia	1	1	0	0.2	0.2	0.0
Florida	112	67	45	10.9	4.8	6.1
Georgia	86	44	42	10.1	3.2	6.9
Idaho	125	68	57	5.7	1.9	3.8
Illinois	122	70	52	53.7	14.0	39.7
Indiana	94	29	65	16.3	5.7	10.6
Iowa	161	101	60	15.8	9.5	6.3
Kansas	179	83	96	17.5	5.6	11.9
Kentucky	74	48	26	13.7	6.9	6.8
Louisiana	83	49	34	17.6	12.2	5.4
Maine	44	26	18	7.1	3.5	3.6
Maryland	23	18	5	14.7	11.0	3.7
Massachusetts	44	22	22	43.7	8.3	35.4
Michigan	152	75	77	19.3	4.2	15.1
Minnesota	111	46	65	12.5	2.4	10.1
Mississippi	87	50	37	4.0	2.5	1.5
Missouri	188	148	40	22.0	10.5	11.5
Montana	142	80	62	16.6	4.8	11.8
Nebraska	182	139	43	25.9	13.3	12.3
Nevada	40	25	15	5.1	3.0	2.1
New Hampshire	21	7	14	4.7	3.2	1.5
New Jersey	36	26	10	68.7	8.1	60.6
New Mexico	76	45	31	9.8	4.1	5.7
New York	97	52	45	97.7	19.4	78.3
North Carolina	84	48	36	19.3	8.2	11.1
North Dakota	59	32	27	7.8	2.9	4.9
Ohio	130	99	31	47.8	35.0	12.8
Oklahoma	138	90	48	27.2	15.1	12.1
Oregon	106	49	57	8.6	3.2	5.4
Pennsylvania	88	51	37	29.0	9.7	19.3
Rhode Island	5	4	1	2.8	1.2	1.6
South Carolina	79	47	32	11.9	7.1	4.8
South Dakota	126	96	30	11.8	7.6	4.2
Tennessee	65	39	26	16.5	3.7	12.8
Texas	306	175	131	46.3	19.9	26.4
Utah	45	20	25	6.0	1.8	4.2
Vermont	14	4	10	3.6	0.7	2.9
Virginia	42	26	16	14.2	9.7	4.5
Washington	101	59	42	16.8	6.9	9.9
West Virginia	35	23	12	13.7	8.0	5.7
Wisconsin	111	68	43	30.6	17.1	13.5
Wyoming	49	17	32	6.4	1.2	5.2
Alaska	25	22	3	5.5	5.3	0.2
Hawaii	23	10	13	9.6	3.6	6.0
Puerto Rico	13	7	6	16.4	15.4	1.0
Total United States	4,431	2,550	1,881	$985.8	$378.9	$606.9

be entirely new projects, 1,100 Class 2 airports, including 530 new terminals, 535 Class 3 fields with 145 of these new projects, 417 fields of the Class 4 and above size, and 164 seaplane airports. Of the 417 Class 4 or larger terminals, only 14 would be entirely new, leaving 403 fields to be improved. The 164 seaplane airports will consist of 153 new jobs and 11 improvement projects. With this breakdown, all types of new projects would total 2,550, with their cost placed at $378,900,000. Cost of the improvement projects, which total 1,881, is estimated at $606,900,000. Other data relating to the national program are given in Table 3.

How the plan will operate

In seeking federal aid for construction work, the local sponsors must first apply on CAA Form 1623. In most states the local community deals directly with the district offices of CAA. However, the laws of five states—Wyoming, South Carolina, Minnesota, Michigan and Massachusetts—require that local groups apply for aid through the state aeronautics commission or its counterpart. Following approval by the Washington staff of the CAA, the sponsor is told to prepare plans in accordance with the standard procedure suggested by the CAA. With these plans approved, the federal aid is granted.

To permit most effective use of the federal funds under this plan, the CAA has assembled extensive material, some of which is listed in Table 2, that should be of great assistance to local engineers and consultants alike. The CAA has also worked up a set of 27 typical plans, sets of which can be obtained without charge from the various CAA offices.

Further aids are available in the form of wind rose charts for the principal Weather Bureau stations.

Because of the time that has been needed for the sponsors to prepare plans and for the CAA to work out the detailed procedure to be followed, as yet no city has been instructed to start the construction to be done with the federal aid listed in Table 1. However, it is anticipated that by April 1 the sponsors of numerous projects will have had their plans approved and received instructions to start.

Materials Bottleneck Breaking

***Contents in Brief**—Following elimination of price controls, building materials in general appear to be catching up with demand, a recent ENR survey shows. Chief consequence of the increasing supply of materials is the growth of buyer resistance in many areas.*

AN OFFER of form-grade plywood at $215 per M.sq.ft. was made recently to a prominent New York contractor. He refused to buy. Some hours later the price was reduced to $185—and still later to $110.

Similar, although perhaps less spectacular, incidents are occurring with increasing frequency throughout the nation, according to the fourth in a series of spot checks of key cities conducted by *ENR*. In the two-month period that has elapsed since price controls were lifted, building materials in distribution channels have increased notably and, here and there, appear to be catching up to the immediate demand. Increasing production, the normal winter slackening of building operations and rigid government restrictions on non-residential construction apparently are the principal factors responsible for this improvement in the supply situation.

Adequate supplies increase

On the basis of the slow but steady upturn in availability of essential materials shown by the series of surveys made over the last seven months, it appears that builders in more than 50 percent of the cities can now obtain adequate supplies. Assuming that present rates of production and distribution are maintained, it can be expected that by spring almost all builders in more than 75 percent of U. S. cities will find ample materials for work that is under way.

These conclusions should not be interpreted to mean that materials for every "dream" project will be obtainable in the near future. They do mean that material-caused delays on work where construction is under way or imminent are approaching the vanishing point.

These conclusions are based on the above-mentioned series of spot checks of the availability of certain structural materials in 12 key cities, measured against local demand (*ENR* Nov. 28, 1946, vol. p. 701). The cities selected are: Atlanta, Ga.; Austin, Texas; Boston, Mass.; Buffalo, N. Y.; Chicago, Ill.; Cleveland, Ohio; Jackson, Miss.; Kansas City, Mo.; Minneapolis, Minn.; New York, N. Y.; St. Louis, Mo.; and San Francisco, Calif.

The method adopted, evaluating availability in terms of actual demand, produces a more accurate picture of the supply situation than the usual practice of comparing total production with a hypothetical construction goal. One of the most significant facts revealed by the surveys is the often-overlooked time-lag between production of a material and its eventual distribution to the local builder when inventories are negligible. Last year, while government and industry representatives reported steady increases in production of most materials, except during strikes, *ENR* polls continued to show only very slow changes for the better. In part, this was also the result of tremendous backlogs of orders that literally ate up the meager supplies as they became available and permitted virtually no stockpiling.

Production records broken

While the amount of materials in distribution channels is all-important, high production rates should be credited for their presence there. According to government reports, past production records are being exceeded for many building products. The Department of Commerce composite index of production, based on 16 selected construction materials with monthly production in 1939 as 100, rose, for instance, from 83.8 in Dec., 1945, to 159.5 in Oct., 1946. A slight seasonal drop was shown in the following months.

In 1946, production of lumber increased from less than 2,000,000,000 b.ft. per month to almost 3,500,000,000, the highest during any month since 1929. On the other hand, behind the poor showing made by softwood plywood in the *ENR* surveys is the fact that output of this material remained nearly static at slightly more than 100,000,000 sq.ft. per month.

Among the outstanding examples of improved production are gypsum board and lath, turned out at rates, as reported by the Civilian Production Administration, increasing from 200,000,000 sq.ft. per month in Feb., 1946, to 326,000,000 in October; asphalt roofing material from 5,000,000 squares per month to 7,000,000; clay sewer pipe from 50,000 tons per month to about 112,000; cast-iron soil pipe from 27,000 tons per month to 47,000; wire nails from 25,000 tons per month to 71,000; and cast-iron and convector radiation from 3,000,000 sq.ft. per month to 7,400,000.

Brick production rose to 528,000,000 in Oct., 1946, 28 percent over the average monthly output during the record year 1941. Output of tile in this month was 133,000 tons, nearly equaling average monthly production in the high year of 1939. Production of warm-air furnaces also reached an all-time high of 82,800, about 75 percent above the peak year 1941.

These high production rates account for the improved availability of materials to the consumer and lead to the prediction that a near balance between supply and actual demand for almost all building products may not be too far off. However, two sobering facts have to be considered in connection with this conclusion. First is that stocks have been drained to such an extent that vast quantities are required to refill depleted inventories, and secondly, distribution is often maladjusted to demand.

A secondary effect of low inven-

tories is to decrease the productivity of labor. Many labor leaders and contractors agree that a good deal of current labor inefficiency is caused by reluctance of the men to work themselves out of their jobs. For example, if a bricklayer sees only 900 brick piled on the site, he is not likely to lay up his full quota of 450 per day when he can stretch his work to three days by setting only 300.

Maldistribution evident

A result of war-induced unbalance between supply and demand, maldistribution of building materials is in large measure responsible for the long-drawn-out construction periods of the past two years. Based on the general shift of most materials checked in the surveys (see accompanying table) from what amounts to "very critical" to "less critical" columns, it now appears that distribution has improved markedly. A general shortening of the construction period can thus be expected, barring serious labor shortages.

In interpreting the four surveys, a law of statistical distribution would be an aid in appraising the results. For example, in a case where supply is 25 percent below demand, actual conditions are somewhere between the extremes where 75 percent of all builders can obtain 100 percent of the materials they need, and 100 percent of builders can get 75 percent of the materials.

When the table is read from right to left, the general improvement in the situation is obvious. Reports from Minneapolis, Cleveland, St. Louis, New York, Buffalo, Kansas City and Chicago show that face and common brick, cement, concrete block and lumber over 2 in. are already in ample supply. Only one material—plywood—has failed to follow the general trend, remaining almost static relative to demand. The most probable explanation is that demand is extraordinarily high, because this material is a vital component of almost all types of housing, and production has not increased sufficiently to meet current needs.

While the *ENR* surveys emphasize structural materials, reports show that shortages of other materials also held up building. In order of importance, these bottlenecks, as of last summer, were: Plumbing, hardwood flooring, gypsum lath, millwork, nails, plaster, shingles, doors and soil pipe. Since then, however, indications are that in general the supply of these materials has improved in accord with the trend.

One city experiencing shortages in most materials is San Francisco. Though reported scarce, plywood, brick, nails and lumber are available, but "at a price". It appears that these materials are there, but dealers reportedly make them hard to get unless they can be tempted to reach under their counters. While cement is in sufficient supply, there is a scramble to obtain future commitments, because proposed highways threaten to absorb this item.

Buyer resistance developing

A sidelight of the last survey is the apparent development of buyer resistance following the removal of price controls, general easing of shortages, the gradual appearance of improved-quality materials and the possibility that prices may ease.

In Minneapolis, builders and dealers were reported hesitating to stock lumber because of expected price drops and fear of a shrinking market due to current high costs. Several carloads of lumber were reported standing on local sidings while distributors tried unsuccessfully to peddle them at fairly high figures. Demurrage costs may force a lowering of price on these shipments to get them off the cars. Increasing availability of lumber also was expected to force cancellation of double and triple orders.

Similarly, while lumber of 1½ in. and under has been rolling into New England, buyer resistance has developed against prevailing high prices. Retail dealers, contractors and builders are holding off in the belief that prices are going to tumble. As a result, boards of all species are reported to be piling up in the lumber yards of this area.

In some areas of Missouri, the supply of concrete blocks appears to equal demand. The explanation offered is that, during the heavy demand of some months ago, many new cement-block plants sprang up, and the block, hurriedly turned out for quick profit, were in many cases of poor quality. Buyer resistance developed through distrust of the product. As sales fell off, many of the "fly-by-night" producers ceased operations, leaving mainly the established manufacturers, who apparently can satisfy the current lowered demand for concrete block.

BUILDING MATERIAL SUPPLY AND DEMAND IN 12 CITIES

(Percentages shown are the amounts by which the supply is below demand; numbers are cities reporting in each category)

Material	0–25 percent				25–50 percent				50–75 percent			
	Jan. 23	Nov. 28	Aug. 1	June 27	Jan. 23	Nov. 28	Aug. 1	June 27	Jan. 23	Nov. 28	Aug. 1	June 27
Brick, common	9	8	4	5	2	4	2	5	1	0	6	2
Brick, face	8	6	3	2	3	6	4	5	1	0	5	5
Tile, hollow partition	6	3	1	5	5	4	4	4	1	5	7	3
Tile, bearing	6	3	3	5	5	5	3	4	1	4	6	3
Glass, plate	6	5	3	4	5	3	4	2	1	4	5	6
Concrete block	10	9	3	9	2	3	4	2	0	0	5	1
Lumber 1½ in. and under	6	3	1	2	5	6	4	3	1	3	7	7
Lumber, 2 in. and over	5	4	1	2	6	6	6	2	0	2	5	8
Lumber, heavy timbers	6	2	0	1	6	6	6	4	0	4	6	7
Plywood, 5-ply waterproof	1	1	1	1	7	5	3	2	4	6	8	9
Plywood, 3-ply	2	2	1	1	6	4	3	0	4	6	8	11
Steel, structural	5	4	4	1	6	7	5	5	1	1	3	6
Steel, reinforcing bars	6	1	3	1	3	7	4	3	3	4	5	8
Cement	10	9	6	8	1	3	3	4	1	0	1	0
Labor, common	10	7	11	7	2	5	1	5	0	0	0	0
Labor, skilled	6	5	7	4	6	7	3	6	0	0	2	2

Congress—Construction Weathervane

WHETHER construction is good or bad, clear or cloudy rests partly with Congress. And in its role as a construction weathervane in 1947, it seems destined to swing the accent to private industry and away from federally-financed public works under the leadership of its new economy-minded Republican leadership. The Congressional reorganization law adopted last summer and the GOP victory in November have placed legislation affecting the building industry in new hands, as shown in the accompanying table.

The sentiment among many top Congressional leaders is toward retrenchment, rather than expansion. The chairmen of both the House and the Senate appropriations committees are demanding an item-by-item review of the $1,400,000,000 for construction and planning in President Truman's budget requests for the fiscal year beginning July 1, 1947. The tendency seems toward cutting on "construction" and to concentrate on "planning" in line with the theory of creating a backlog of public works.

The same thoughts permeate the Senate and House committees on public works, which are responsible for any new authorizations on which future claims can be made before the appropriations committees.

The most likely field for new basic legislation lies in the direction of the so-called Wagner-Ellender-Taft general housing program, which passed the Senate last year, but did not reach a vote in the House. Taft, whose powers have broadened under Republican control of Congress, still has his heart set on a program intended to produce 1,500,000 new dwelling units annually for the next 10 years. He has in mind an investment of $6,000,000,000 to $8,000,000,000 a year, 90 per cent to be supplied by private financing.

Taft's chances of getting a housing program through both houses of Congress this year are enhanced by (1) his willingness to compromise disputed points to achieve the ultimate goal; (2) the measured caution with which he is lining up advance support; and (3) his willingness to break last year's omnibus measure into two or more parts so it won't be so hard for Congress to swallow the whole.

Another possibility in the housing construction field relates to rent controls. Rent ceilings on existing housing probably will be extended beyond the June 30 deadline with a proviso allowing increases probably up to 15 per cent. But, it may be accompanied by an amendment eliminating ceilings on new construction, advocated by those who believe that this would encourage rental housing.

Congressional leaders have decided that a stable labor situation is a prerequisite to progress in the construction field, as well as the economic picture generally. So, they have given labor legislation priority. Of the many proposals to amend the Wagner Act and establish machinery for peaceful settlement of labor disputes, those aimed at banning or restricting the closed shop would have the greatest impact on labor conditions in the construction industry.

Many hardy perennials which have failed to win Congressional approval in the past, are back again for the 80th Congress—with meager chance of success. Outstanding among them is the U. S.-Canadian agreement for development of the Great Lakes-St. Lawrence seaway and power project, and included also are proposals for various River Authority programs, stream pollution abatement, a national science foundation and authorizations for appropriations for everything from backwoods roads to a huge stadium in Washington.

MEN WHO PULL THE STRINGS THAT AFFECT CONSTRUCTION IN THE DELIBERATIONS OF THE 80TH CONGRESS

Senate

Appropriations—Styles Bridges, R., N.H.—All funds.

Agriculture—Arthur Capper, R., Kans.—Forest roads, trails and parkways, experimental stations, soil conservation and rural electrification.

Armed Services—Chan Gurney, R., S.D.—All types of military and naval establishments. The Panama Canal.

Banking & Currency—Charles W. Tobey, R., N.H.—Public and private housing, financial aid to commerce and industry, including RFC.

Foreign Relations—Arthur H. Vandenberg, R., Mich.—All international agreements, including the proposed St. Lawrence Seaway.

Interstate & Foreign Commerce—Wallace H. White, Jr., R., Me.—Regulation of all interstate transportation and communication, including civil aeronautics (airports), railroads, highway traffic and pipelines; authorizations for inland waterways.

Labor & Public Welfare—Robert A. Taft, R., O.—Wage and hour laws; mediation and arbitration of labor disputes; veterans rehabilitation, including hospital authorizations.

Public Lands—Hugh Butler, R., Nebr.—Irrigation and reclamation projects; topographical and geological surveys.

Public Works—Chapman Revercomb, R., W. Va.—Flood control and rivers and harbors improvement; navigation and water power; highway construction; stream pollution; and all public buildings including postoffices, customhouses, courthouses, etc.

House

Appropriations—John Taber, R., N.Y.—All funds.

Agriculture—Clifford Hope, R., Kans.—same as Senate.

Armed Services—Walter G. Andrews, R., N.Y.—Same as Senate except for deletion of Panama Canal which is under Committee on Merchant Marine & Fisheries headed by Rep. Fred Bradley, R., Mich.

Banking & Currency—Jesse P. Wolcott, R., Mich.—Same as Senate.

Education & Labor—Fred A. Hartley, R., N.J.—Same as Senate except for veterans' program for which House has as separate committee headed by Rep. Edith Nourse Rogers, R., Mass.

Foreign Affairs—Charles A. Eaton, R., N.J.—Same as Senate.

Interstate & Foreign Commerce—Charles Wolverton, R., N.J.—Similar to Senate.

Public Lands—Richard J. Welch, R., Calif.—Same as Senate.

Public Works—George A. Dondero, R., Mich.—Same as Senate.

Prospects for Prefabrication

***Contents in Brief**—Rapid, successful development of the prefabrication industry depends largely on the quality of houses now being produced. Unless the public is given good dollar-value in factory-built houses, labor opposition, code and zoning restrictions and personal prejudices will seriously retard the growth of this infant industry. With government help, much progress is being made in hurdling these obstacles, as well as in speeding production, improving designs and developing new structural materials. Present trends indicate that the establishment of dealer organizations, much like those of the automobile industry, is the solution to the marketing problem.*

SPEEDING PRODUCTION of factory-built homes is currently viewed by many as the solution to the housing shortage. While the much-publicized prospects of prefabrication are not too far-fetched, an appraisal of the infant industry reveals that despite rapid developments realization of these possibilities is still many years away. Future progress depends on many factors—advancements in manufacturing, distribution and on-site assembly techniques; creation of dealer organizations and promotion methods; cost reduction, labor relations, community planning, and financing; and finally, public acceptance.

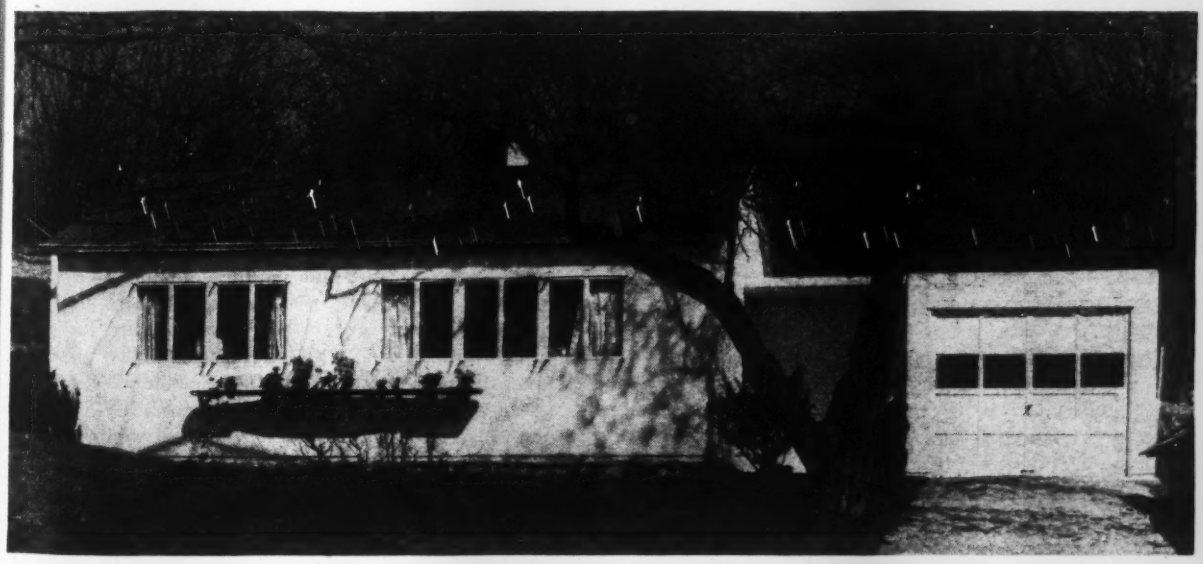
Oddly enough, while the old and the new home-building industries aim at the same end product, they are faced with different problems. In contrast to the conventional-type dwelling, which is constructed piece by piece on the site, a prefabricated house is one in which floors, walls, ceilings and roof are composed of relatively large-size panels, shop-fabricated prior to erection on the site. Thus, the benefits of mass production skills are substituted for the uncertainties of field work, but problems in packaging, transporting, marketing, union jurisdiction and public relations are introduced.

Added significance is given to prefabrication developments by certain trends throughout the construction industry as a whole—as evidenced recently by the use of precast concrete in large industrial buildings, highway bridges, piers and boardwalks, and by more frequent applications of light-gage steel panels for walls, floors and roofs in non-residential construction. The progress being made in dimensional coordination of building materials and installed equipment is also an encouraging sign. But there are also deterrents of which high cost is probably the most important.

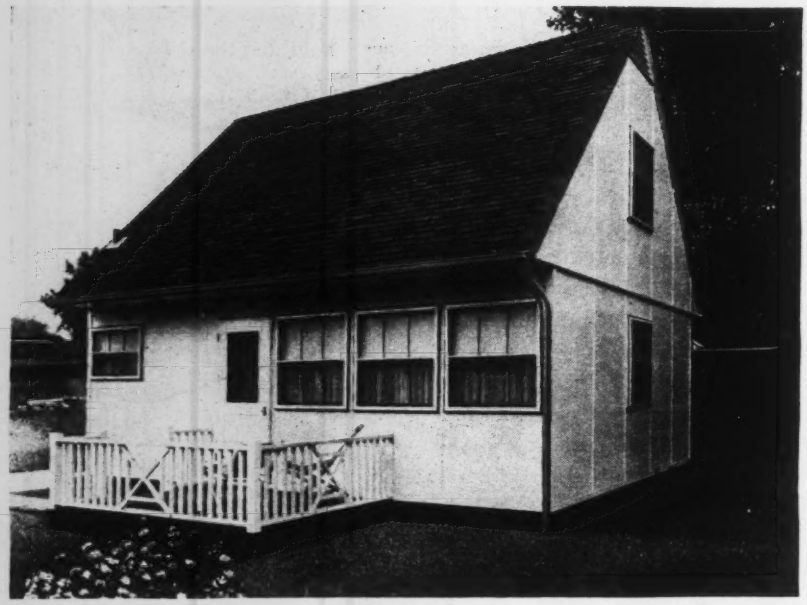
Production and demand fix costs

Chief reason why the industry has not been able to deliver houses at lower prices is that it is not yet in production. Beset by the same material shortages that have haunted conventional builders, most prefabricators have not been able to get production moving on a volume basis. At present a prefabricated house costs about the same as a comparable conventional unit.

Even if prefabs could be produced to undersell conventional houses, real estate men point out that there is no incentive to cut prices, because the entire production currently can be sold on a competitive basis. Despite greater production and increased ef-



"Devon" house of W. H. Harman Corp., Wilmington, Del., is one of several steel models on which production is being started. Company has $38,000,000 guaranteed-market contract for 10,000 houses.



Production started last April on Model 11, shown above, of The HomeOla Corp. Chicago, Ill., which was awarded the first guaranteed-market contract. In the construction of all models, use is made of modular plywood panels.

ficiency, prices will not come down, they say, until the housing shortage has been considerably eased. Eventually, savings will be passed on to the consumer and then prefabs will cost much less than comparable houses.

Housing designs compared

The cost comparison raises the question as to whether a prefabricated house is structurally and architecturally comparable to one of conventional type. During the past several decades millions of dollars have been spent on research on many different systems of prefabrication, and test results show, and actual experience verifies, that a well-designed factory-built unit is as sound structurally as a well-designed conventional house. As far as appearance is concerned, in some cases present-day prefabricated homes cannot be distinguished from conventional types. While much publicity has been given to "miracle" houses of fantastic design, none such is currently being built in any appreciable quantity. Last year a number of factory-built houses of unique design were brought to the fore, and several of these were described in *ENR*, (Feb. 14, vol. p. 250; March 28, vol. p. 444; April 25, vol. p. 679; May 30, vol. p. 831; Oct. 10, vol. p. 479; Oct. 17, vol. p. 534; and Dec. 19, vol. p. 837). But so long as the vast majority of the public prefers conventional-shaped dwellings, factory-built homes will also be manufactured in greatest numbers in the conventional pattern.

At the present time one of the major criticisms levelled at prefabs hits at the relatively small floor area on which some of the models have been standardized. In most cases the small size is due to emergency needs for a minimum house and to the necessity for selling below the $10,000 ceiling set by the government in 1946. Currently, floor areas in all new residences are limited by government edict, but on removal of controls prefabricators expect to produce larger dwellings.

With regard to durability, there appears to be no reason why a well-built, well-maintained prefabricated house, whether of wood, metal or concrete, should not last as long as a conventional structure. Here, too, experience with prefabs indicates that they suffer no greater depreciation than others of the same age.

In any event, if factory-built houses are to be erected within city limits, they will have to satisfy local building codes, which if sincerely enforced will assure the soundness of the design. In addition, the National Bureau of Standards has prepared a standard for prefabricated houses, the National Housing Agency last year qualified about 200 prefabricators for priorities assistance for at least one model, the Federal Housing Administration has approved insurance loans on many types, and lending agencies have to be satisfied as to the soundness of construction before mortgages will be issued.

With the close scrutiny to which factory-built houses are subjected by NHA engineers, a purchaser should experience little difficulty in financing a government-approved prefab other than that commonly met in the financing of conventional houses. It is reported that savings and loan institutions throughout the country are financing approved prefab structures.

Attitude of public

There has been some doubt, however, as to public acceptance of the factory-built house. As long as the present housing shortage exists, people will have to accept almost any form of shelter, but the important question remains as to what the public's attitude will be toward prefabrication when the housing market contracts.

To some extent the answer may be found in the experiences of the automobile and airplane industries. Whereas all vehicles years ago were custom-built, today very few people would consider the purchase of any but a mass-produced unit. The appearance of the modern car or plane, as well as many of the details of construction, has constantly been improved and is markedly different from the early models. The consensus of housing experts is that the prefabrication industry will most probably repeat this experience.

Polls indicate that the public is not prejudiced against factory-built houses any more than against factory-built automobiles, but is chiefly concerned with the final product. "Cracker-box" designs and the publicity given impracticable "miracle" houses of fantastic shape, however, have tended to stigmatize the word "prefabrication" in the public's mind.

Likewise, the industry is hurt by premature distribution of new designs. For example, some authorities have expressed concern over the durability of some thin-walled constructions and of the danger of selling models from which condensation

problems have not been eliminated. Nevertheless there is strong evidence that the public will accept a prefabricated dwelling as readily as a conventional one, if satisfied that it compares favorably.

What the public thinks as individuals is, however, often far different from its attitude on the community level. While individuals may favor factory-built houses, considerable resistance to prefabrication may be exerted by the community through zoning ordinances, building codes, deed restrictions and other local limitations. Even the finest prefabricated house cannot now be erected in many cities in the United States. However, if the prefabrication industry can produce good houses, then consumer pressure will remove these obstacles.

Community opposition can only delay, not prevent, the advent of the prefabricated house, housing experts believe, but a lot depends on the prefabricators themselves. If present restrictions are to be abolished, manufacturers must produce houses of high public appeal. No community can fight for long against factory construction, when prefabs of attractive appearance and offering more per dollar than conventional homes are being erected in large quantities in neighboring localities.

Labor problems

Another problem the industry must overcome is that of labor opposition, which is currently less heated than in prewar years because of full employment in the building trades. It did not come to a head in 1946 because the employees of most of the existing small prefabricators are organized by the American Federation of Labor and because, with materials short anyway, the unions winked at factory installation of wiring and plumbing. But this year, or maybe next, with firms having employees organized by the Congress of Industrial Organizations coming into the picture, and with greater emphasis on complete prefabrication, labor opposition and jurisdictional disputes may prove troublesome. Hope is being expressed that in this case there will be enough support from veterans to override the opposition, even if it is necessary to play one union group against the other, turning to the CIO for erection crews for CIO-packaged houses.

Here again, a lot depends on the quality of factory-built houses. If consumer pressure can force revision of zoning ordinances and building codes then it can also smash labor opposition.

On the national level, the government has a stake in the prefabrication industry. With the appointment of Wilson W. Wyatt as housing expediter and NHA administrator in January, 1946, the government committed itself to push prefabrication as a solution to the housing emergency. Wyatt tried to set up substantial prefabrication firms, guaranteeing them a market, providing them with factories from the government pool of surplus war plants, arranging Reconstruction Finance Corp. loans for their working capital, and working out distributing arrangements for their products, but keeping the whole job formally on a private basis.

This program was organized around the production of metal prefabs, as opposed to the type then being built, which was almost entirely of wood. The emphasis on steel and aluminum as building materials had a double origin:

1. By exertion of his priority powers, Wyatt believed he could get metal for housing by taking it away from non-housing users, whereas favoring more familiar types of prefabrication merely moved materials from one kind of housing to another.

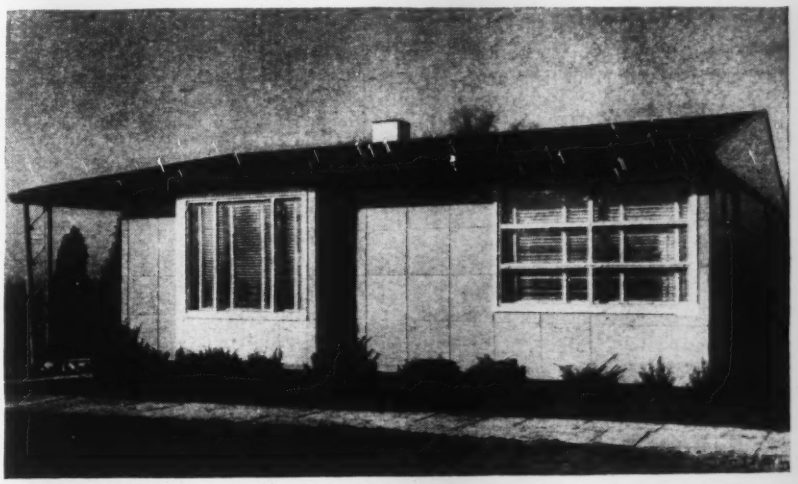
2. For the long run, NHA engineers hold that metal is more amenable to mass production than wood. Thus, while at the beginning of this year factory-built metal houses may cost somewhat more than wood ones, if real quantity production is attained during the latter part of the year, it is believed that costs can be reduced well below that of comparable houses now being built. In addition, proponents of metal houses argue that they offer more for the money in durability and low maintenance.

Why program failed in first year

In 1946, prefabrication was Wyatt's biggest disappointment with respect to his program. Relying on the industry's own estimate of its capacity and allowing for some expansion, he originally scheduled a production of 250,000 prefabs. Production was slow to pick up, and as output crept along at 2,000 to 3,000 a month, Wyatt cut the goal to 100,000. At the year's end, the total was less than 40,000 units.

Much of the trouble, Washington observers say, lay in the fact that prefabs of the type then being built used almost identically the same materials as conventional dwellings. More than two-thirds of them were of wood frame construction—simply ordinary houses built indoors. Most of the rest relied on plywood, which is an important component of most houses. Hardly more than 3 percent were of metal.

The material shortages plaguing house builders have been even more



"Esquire" model of Lustron Corp., Chicago, Ill., expected to sell at about $4,200 f.o.b. factory, has porcelain-enamel exterior and steel frame. A $12,500,000 RFC loan has recently been negotiated.

crippling to the prefabricators. Production-line operations are intrinsically vulnerable to shortages. A conventional builder can schedule his work as materials arrive on the job —putting in walls while he waits for windows—but the prefabricator needs all the materials on hand before he can start work. Moreover, the Wyatt program was running several months before priority arrangements were set up by which a prefabricator could accumulate sufficient inventories.

Another factor to be considered is that the present prefabrication industry largely is made up of small firms, each turning out a few hundred houses a year. Their buying pressure, in a tight market, is unequal to that of established building supply houses serving conventional builders. And their output is too low in most cases to permit production tooling much more elaborate than that of a local milling shop.

Prospects for 1947

Despite Wyatt's resignation at the end of 1946, his successor Frank R. Creedon, acted to continue the guaranteed-market contracts, made available under the Veterans Emergency Housing Act, to spur the production of new-type building materials for factory-built houses. Housing officials expect that production of prefabs will get into high speed toward the end of 1947, taking the industry into 1948 with a production rate geared to match or surpass that of conventional builders. If the government's program works, a two-billion-dollar industry will have been created and a complete revolution in the house-building business effected in two years, with the bulk of it centered in factory operations instead of on the building lot.

At last report, five companies have guaranteed market contracts: American Fabricators, Inc., Louisville, Ky.; Knox Corp., Thomson, Ga.; HomeOla Corp., Chicago, Ill.; William H. Harman Corp., Philadelphia, Pa.; and General Panel Corp., Los Angeles, Calif. For some time active negotiations have been under way with Lustron Corp., Consolidated-Vultee Aircraft, Reliance Homes, Inc., Higgins Industries, General Homes, Inc., and Clements, Inc. Most of these companies have had considerable experience in the art of mass production. More tentatively interested are other experienced firms, such as Douglas Aircraft, Ryan Aeronautical, Goodyear Aircraft, Taylorcraft Aviation, McDonnell Aircraft, Martin Aircraft, Bell Aircraft, Bendix, and Kellett Autogyro.

No outright government contracts

What many of the aircraft companies first hoped for was an outright government contract for houses. Under the present guaranteed market arrangement, however, RFC is obligated only to purchase unsold units at 90 percent of the manufacturer's lowest standard delivery price, or his actual cost, whichever is lower. To protect the RFC against paying for excessive cost, a maximum limit is fixed in determining the government's liability. Homes produced under the contract are subject to the same requirements as those constructed by conventional builders, such as veterans preference, 1,500-sq.ft. area, year-round occupancy, and rental ceilings.

Most manufacturers of factory-built houses distribute their products through local dealers, who operate on a franchise similar to that used in many other industries, polls show. Given a territory within which they enjoy exclusive rights to sell a particular brand, in most cases dealers purchase the prefabs from the factory and resell them to consumers at a price determined for the area by the manufacturer.

A study of these local dealers indicates that they are men with a background of experience in the home-promotion, erection and sales fields. Exceptions are usually men or organizations who have an interest in one of the allied fields, such as mortgage loans, real estate, building materials or land development. It is unusual for a prefabricator to form a dealer organization of persons not hitherto operating in the field.

The dealer's job is simply to sell prefabricated homes and to get them financed and erected. Typical dealers attempt to develop sidelines, such as financing, selling lots, and providing maintenance and resale services.

Some idea as to how dealers may operate is given in a report on prefabricated homes, briefed by James C. Downs, Jr., president, Real Estate Research Corp., Chicago, in *Headlines*, a publication of the National Association of Real Estate Boards, Nov. 25, 1946. The hypothetical procedure would be about as follows:

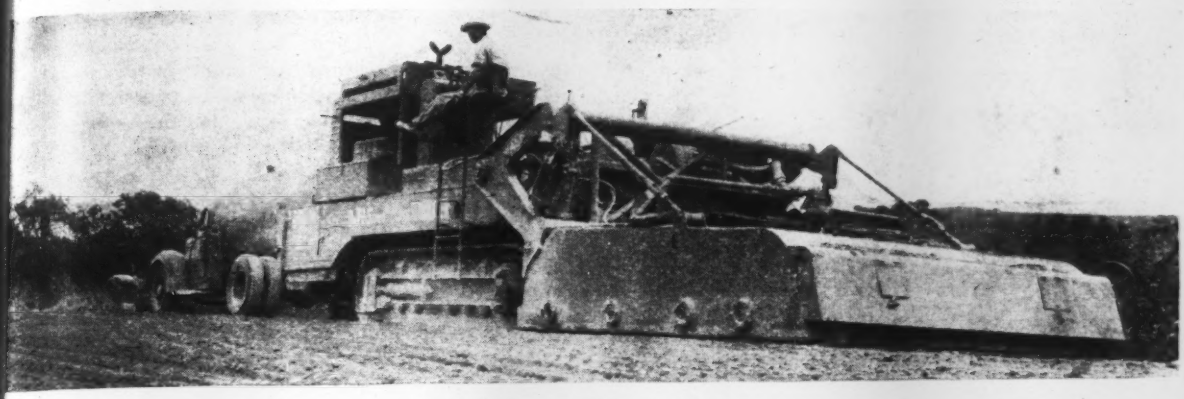
In a typical instance, Mr. Smith, who is a veteran, will be induced to call on a dealer through national advertising campaigns. If he does not already have a lot, the dealer will unquestionably endeavor to interest him in one in an area where the erection of prefabricated homes is not prohibited. Mr. Smith will then be shown a catalog illustrating the exteriors and interiors of the latest models and will be quoted prices for the completed house, the amount of the down payment, the monthly installment necessary to carry the anticipated mortgage and estimates of the cost of maintenance. In short, he will be handled by a dealer schooled in the psychology of selling.

When Mr. Smith has signed on the dotted line, the physical part of the dealer's job begins. He must send his order to the factory, together with a complete list of electives, such as price, color, sizes, etc. He must get a delivery date from the factory, then engage and schedule his erection crew, complete the financing, and arrange for insurance, landscaping and whatever other sidelines he has developed. He must follow through on all phases of Mr. Smith's purchase until he finally makes delivery of the house by turning over the keys.

Effect on conventional builders

The number of dealers will probably grow as community resistance disappears. On the other hand, there will probably be a drop within the next few years in the number of prefabricators, real estate men believe, and the industry will be centered in a few large firms, big enough to finance large factory operations and to achieve the economies of large-scale production.

Present predictions are that if prefabricators do succeed in capturing the low-priced home market, conventional builders will be compelled to shift their operations to the higher priced field, which is considerably smaller. Thus, it is probable that as the prefabrication industry grows the total number of firms will decrease, with marginal operators eliminated first and the more efficient builders expanding or being absorbed into larger organizations.



Trend in equipment is to larger machines to cut down man-hours but this single-pass stabilizer goes farther than most.

Tomorrow's Construction Machines

Vincent B. Smith
Associate Editor, Engineering News-Record

***Contents in Brief**—A survey of equipment manufacturers indicates that new models deferred by the war and its after-effects will reach the market within the next year. In general, new models are improved designs of basic types already known to the construction industry; they will supplement and not supersede existing models now being produced. No radical innovations are contemplated for the immediate future. Discussed here are the promising prospects for continued development of construction machines and the mechanical components that enter into them.*

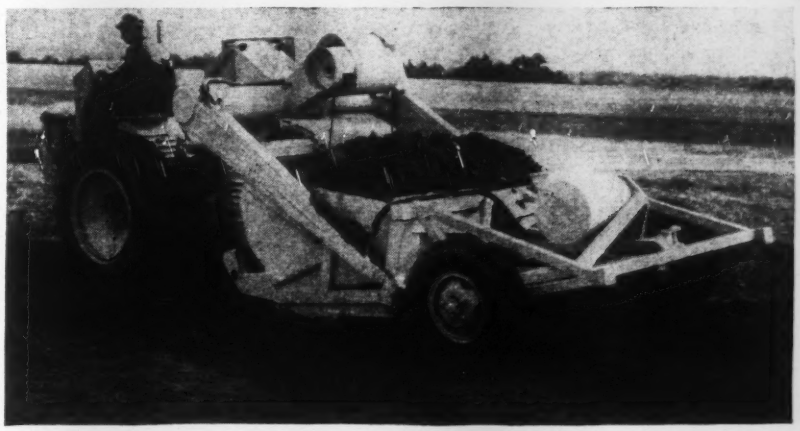
FREED from the shackles of wartime restrictions, manufacturers of construction equipment are rapidly regaining the capacity to transform new ideas into working models for sale to a hungry market. A recent survey indicates that new models will reach that market in increasing numbers during the current year.

Effects of the war, however, are still strongly felt in the construction equipment business. A yawning gulf of unfilled orders has yet to be bridged. Critical materials and parts are extremely short; some manufacturers are now building machines with materials ordered 12 months ago or even earlier.

But war intensified research in fields such as fuels, lubricants and rubber; construction equipment derived permanent benefit from that research. Accelerated production requirements caused gains in numbers of skilled shop workmen and in knowledge of new techniques. Welding is one example of an art which expanded rapidly during the war. Notable advances were made in hydraulic applications to machines and in development of special steels.

Government efforts to control the aftermath of war have inevitably hampered manufacturers' freedom to develop new products. Needed engineering personnel is hard to get. Strikes have caused stoppages in many plants. For these many reasons, the first postwar Road Show will be held in 1948 instead of in 1947, as originally proposed.

To make a broad, general observation, it may be predicted that new



Powered by an 85-hp. gasoline engine, this tractor-scraper combination has a speed of 23 mph. and positive steering through electric control by individual motors on each of the two wheels of the hauling unit. New electric control system eliminates need of cable control unit for 3.3 cu.yd. scraper.

models reaching the market within the next two or three years will supplement machines and vehicles already in service and will displace only those units that are waiting to be junked.

The future for earthmoving

Earthmoving equipment has been one of the leaders of construction development for many years. Some questions arise with regard to its future.

Has equipment for excavating, loading and hauling reached the top of the sharp rise in its curve of increasing efficiency? Is it now entered upon a period of more gradual improvement and refinement? A good many experienced construction men incline to the latter view, believing major cost saving in the future will come through good management and skilled supervision rather than through radical increases in equipment efficiency. Others give only partial assent to such a theory. Possibly the basic types of earthmoving, hauling and material-handling equipment are already here, but it is hard to believe that radical improvements will not be forthcoming in a future of rapid technical progress.

Tracks or rubber?

A definite current trend to rubber traction is strongly evident in construction equipment. Manufacturers of track-laying tractors recognize that trend and favor it. These manufacturers make rubber-tired tractors as well as the crawler units. Relying upon the self-evident economic fact that rubber-tired tractors will be adopted only as they make possible further reduction in construction costs, the manufacturers are confident that increased volume of construction work brought about through the lowered cost will create an expanding market for track-type tractors as well. Crawler models, they reason, will be needed in greater numbers for heavy, slow-speed operations. Also, war-developed rubber tracks open possibilities for higher-speed crawler-type tractors.

Increase in power of track-laying tractors goes steadily forward. One manufacturer recently announced production of a unit that develops 132 drawbar horsepower. This tractor is equipped with a torque converter between the engine driveshaft and a conventional gear transmission assembly. Before midsummer, another manufacturer expects to have in production a track-laying tractor of 130 drawbar horsepower.

Two- or four-wheel tractors?

Two manufacturers are successful producers of two-wheel tractors. Additional makers are building and testing models that may reach the market within a year or two. One of the two present producers has from the beginning incorporated in its two-wheel tractors positive steering control through a hydraulic mechanism which turns both wheels in the same direction at the same time. The second manufacturer has adopted positive steering in its newest model. It may be predicted that positive steering will be generally adopted on two-wheel tractors.

Superior traction claimed for the two-wheel tractor, through putting all the weight on the drive wheels, has not persuaded all manufacturers to adopt that type. Some prefer the greater stability, steering ease and versatility of the four-wheel rubber-tired tractor, which can move about freely when detached from trailer wagon or scraper. Properly balanced design of a four-wheel tractor allows nearly all the weight to shift to the rear drive wheels when the pulling is hardest.

There is apparently no limit to the equipment that inventors can build onto a tractor. Just now, front-end and overhead shovels are in great demand for housing and other construction. A number of them are rugged enough to handle heavy grading and digging. We can look forward to many additional innovations in tractor attachments. Close cooperation of the manufacturers of trac-

To be in production by summer, this tractor delivers 130-hp. at the drawbar from a diesel engine with a maximum speed of 1,300 rpm. It has eight speeds forward and eight reverse.

Small wheel-tractor incorporates air compressor without impairing usefulness as a power unit. It is used here to power earth auger for drilling holes.

tors with the makers of allied equipment assures well-engineered combinations. Some are experimenting now with bulldozers on pneumatic-tired tractors.

Adaptability of tractors to many purposes is amply illustrated by the multitude of conversions of the industrial wheel tractor. Many ingenious manufacturers transform them into innumerable varieties of construction machines, such as road rollers, cranes, motor graders, front-end loaders, shovels and hauling units. A 105-cfm. air compressor has been built into a small wheel tractor, without inhibiting the tractor's usefulness for general purposes. The future will see almost unlimited development of the industrial wheel tractor's possibilities.

Portable compressors are available in sizes from 60 to 630 cfm. and are frequently hooked up in combination for large air requirements. Preference is for rubber-tire mounting and diesel power on compressors while wagon drills using steels with detachable bits are replacing hand-held drills and formed steels.

Machines for excavation

Improvements and innovations have also occurred in the excavator field. For shovels, efforts now are being made by manufacturers to increase the speed of both dipper loading and swing.

Power controls and mechanical improvements such as torque converters have added to the ease and smoothness of operation. In both engine-driven and electric shovels these new features have afforded fingertip control, improved output, given greater protection to the machinery, furnished smoother driving power, diminished overload hazards and decreased the drain on the human energy of the operator.

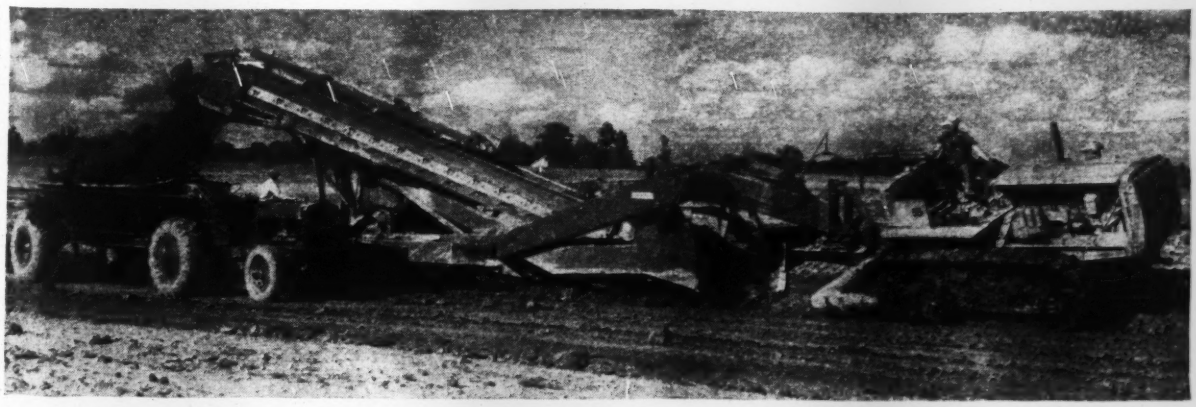
Electric shovels have been built in which power is transmitted to the hoist drum through a relatively simple electro-magnetic drive which eliminates sliding gears and mechanical clutches. The same type of electric clutch is in use on engine-driven excavators to transmit power to the swing motion, replacing frictional connections. Other electrical applications to improve excavator performance may be expected.

An expanding future is ahead for the rubber-tired truck crane and excavator which can move without a trailer from job to job with relative freedom from highway weight and clearance limitations. But, where weight distribution with low unit pressure is necessary under heavy machines, especially when the machines must move frequently a few feet at a time, crawler traction will continue to prevail. Crawler tracks are being improved in design, with better metals, shoes, pins and rollers for longer life and elimination of breakage and delay.

Combined digger-belt conveyors

For several years, experimental models have been tested of a conveyor shovel that loads continuously by a moving belt into vehicles or onto a belt conveyor trailer unit coupled to the shovel at the rear. The conveyor shovel is said to increase excavation output greatly over conventional dipper shovels of comparable size. Production accelerates still more when the machine handles sand, gravel, loam, pea coal or similar materials. The unit is convertible to a dragline.

Before the end of the war, one manufacturer introduced a successful tractor-drawn mobile excavator and loader, on crawler mounting, equipped with a 54-in. belt driven by a 150-hp. diesel engine. In fair



Tractor-drawn mobile loader, mounted on crawler tracks, has 54-in. belt driven by 150-hp. diesel engine. In good dirt loader is capable of loading 13 cu. yd. wagon in less than 45 sec.

Bottom-dump trailer wagons of 33-cu.yd. water-level capacity drawn by 200-hp. diesel trucks haul huge loads into airport fill at San Francisco. Trailer load is supported on 16 pneumatic tires.

digging, the loader can put a 20-ton load into a wagon in ¾ min. or less.

For drilling in open-cut rock excavation, the trend is increasingly toward the wagon drill and away from the hand-held drill. In tunnels, the automatic feed drifter has completely replaced the hand-cranked drill. Tunnel drill-jumbos tend toward power adjustment, mechanical or hydraulic, for shifting the individual drill and its support. The jumbo frame may be supported on a railway carriage, truck or tractor.

Factory-made detachable bits have practically replaced the formed steels, in which the bits are forged on the drill rods. Efficient machinery for reconditioning the detachable bits has speeded this change.

Belt conveyors

Two recent developments in belt conveyors have greatly enlarged the scope and effectiveness of this type of equipment for mass transportation of earth and other materials. One of these developments is the steel-corded belt in which longitudinal wire ropes embedded in the body of the belt so increase the tensile strength as to allow single flights to be extended to lengths of as much as 3 miles between pulley centers. These belts are obtainable in widths up to 72 inches.

A second development, which greatly increases enonomy of belt transportation, for some applications, is the two-way belt conveyor. This system, recently announced by one of the belt manufacturers, permits loads to be carried on the return run as efficiently as on the forward run of the belt. The return run can be installed parallel to the forward run or at an angle to it. Because the wearing surface always faces upward, the lower surface cannot collect dirt to be ground into the lower side of the belt in passing over the pulleys.

Trucks move ahead in efficiency

Trucks have increased in size, speed, horsepower output and durability. Within limits, growth in those respects will continue. One truck manufacturer today offers 16 standard models up to 90,000-lb. gross rating. Diesel engines are standard for some large trucks, particularly construction models, and are optional for others.

Some truck company engineers expect improvements in gasoline to offset partly the present fuel advantages of the diesel engine; the price advantage is diminishing with changes in taxation on diesel fuel for on-the-road vehicles. These engineers feel that there is great opportunity for improvement of the gasoline power package, perhaps eventually to the extent of reducing the engine to two-thirds its present size for the same power output.

Looking at the overall picture for all kinds of trucks, the gasoline engine remains the preferred power plant. Some construction operators want it because it is easier to start, especially in cold weather. But diesel manufacturers have not stopped improving their engines. One diesel executive recently stated that to compete with gasoline in trucks of 1½-ton capacity and smaller, engine costs must be cut from $15 at present to $5 per horsepower. His company is aiming for a share of the business in smaller trucks. All truck users will gain from such aggressive competition.

All-wheel drive and four-wheel tandem drive have improved truck traction in cross-country and off-the-highway service. Drives of this type have increased the working capacity of the motor grader and the mobility of the self-propelled crane on rubber tires.

Future trucks, along with larger power plants, may have torque converters in combination with gear-type transmissions. The fluid flywheel, or hydraulic coupling, possibly could replace the clutch, but it is more likely to be used with a clutch. Heavy-duty power takeoffs will be utilized to drive mounted equipment from the truck engine.

Manufacturers will pay more attention to driver comfort. Cabs will be roomier and more comfortable, with better vision and ventilation. Power steering is here to stay, particularly on larger trucks. It may be either hydraulic or air; the hydraulic type leads today.

In construction machines, preference for diesel power continues to grow. As the diesel engine improves, weight per horsepower goes down. One manufacturer recently announced a 25 percent step-up in power, with no increase in engine size or weight, as a result of improvements in the combustion system and a small increase in engine speed.

Added power can be gained also by supercharging—forcing more air into the cylinders for each combustion cycle. As an example of what manufacturers are doing to increase power in compact automotive diesels for trucks and construction machines, a typical heavy-duty vehicle, built to haul 22 tons of rock or earth, has a diesel engine supercharged to develop 275 hp. maximum at 2,100 rpm. Weight per horsepower is less than 10½ lbs. Another manufacturer now offers a 200 hp. two-cycle diesel that weighs only 8.6 lb. per horsepower.

When there is a demand for them, manufacturers expect to provide high-speed diesels of 400 to 550 hp. for automotive and construction service. But for engine speeds above 3,000 rpm., special fuels would be needed. Some manufacturers think it more prudent to hold to less than 2,300 rpm. and to use common heating oil, which enjoys a fairly stable price on a broadly competitive market, rather than go into premium fuels, which could prove high in cost. Others see the special fuels more than paying their way.

Longer life given tires

As to tires, the war-development of the rayon carcass greatly improved the strength and wearing quality and reduced the heating effect. And now the wire cord tire has come on the market, substituting high tension steel wire for cotton and rayon cord. Wire cord is not affected by heat and has never been known to blow out. Tire makers are experimenting with other fibers and processes to improve quality still further.

Design of the rim has been found to affect directly the utility and life of tires on construction vehicles. Rims recently have been widened and redesigned to increase the tire service life. For 18.00 and larger tires, a new rim design provides a 5-deg. tapered bead seat which has the effect of holding low-pressure tires firmly on the rims of drive wheels and preventing creepage on free-rolling wheels.

Equipment and field practices for mixing and placing concrete are being developed to exploit the potential advantages of air-entraining cement. One of these opportunities is in hauling premixed concrete in open-body trucks from central mixing plants. Air-entrained concrete has less tendency to segregate than concrete made with normal portland cement.

With the proper gradation and water control, air-entrained concrete can be hauled considerable distances.

Air-entraining cement has increased the possibility of hauling pre-mixed concrete in open trucks. Note absence of segregation in this specially designed, high-discharge body, which has a built-in gate and concrete chute.

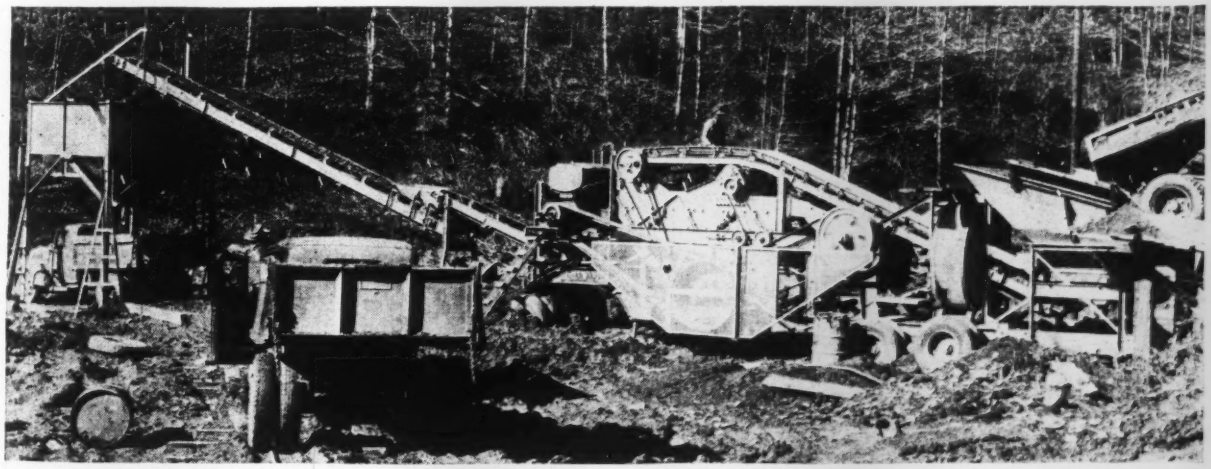
Special dump-truck bodies with rounded corners, high-discharge, rear gate and chute have been developed for hauling and unloading air-entrained concrete, and further improvements are in prospect for the immediate future.

Concrete mixers rugged and fast

Dump-truck haulage will supplement but not displace the accepted method of delivery by truck mixer or agitator. For many operations, particularly where closely controlled discharge is required, the truck mixer offers the most flexible, economical and generally satisfactory means of delivery. Today's high-discharge truck mixer, with feed chute loading, has superseded the horizontally mounted mixer.

Paving mixers have climbed nearer the pinnacle of performance. Long booms, fully-controllable spreading buckets, automatic power controls, faster cycles, greater capacity, gears running in oil, and better guarding and shielding (for both safety and appearance) have marked some of the steps in their continued advance. New models of the 34E, both single-drum and dual-drum, will give added evidence of the upward trend.

Steel paving forms today usually are made of ¼-in. plate to support subgrading, spreading and finishing machines without distortion. They tend also to have wider bases for better support on the subgrade. Special forms have recently been developed to meet the needs of airport paving up to 27 in. thick. Vibrating ma-



Portable crushing and screening plants in dual units like this one are favored for frequent movement as they impose lower loads on the highway as they move on their own pneumatic tires.

chines or attachments to compact dry concrete for roads and airports have become almost a necessary aid to peak production.

Batching and crushing

Batching control has reached a high state of perfection. An automatic batching plant has been reported, which by push-button control will accurately weigh out the water and five separate sizes of aggregate for any one of a large number of predetermined mixes previously set up on the machine. One manufacturer has announced for the future a simple device to eliminate segregation in aggregate bins. Complete portable combination plants up to 1-cu. yd. size for both batching and mixing are in use.

Portable crushing and screening plants, riding from site to site on rubber, have made local materials more readily accessible and more economical to produce. One new model of a portable crushing and screening plant has screens and conveyors driven by electric motors with power from a diesel-electric generator. The crushers are driven by belts from the same diesel engine. Use of electric motors has eliminated belt drives and numerous mechanical power transmission devices. Motors are totally enclosed, fan-cooled, for operation under the dusty conditions that prevail on this type of work.

Highway limitations may in the future cause more use of two-unit portable crushing and screening plants, with the primary crusher in one unit and the secondary crusher, screens and conveyors combined in the other.

In asphalt paving, the trend is denfiitely toward central-plant mixing as contrasted with travel-mix operation, whether for hot-laid or cold-laid mixtures. Plant-mix paving permits better maintenance of traffic and gives more complete control over the materials. Mixing plants and paving equipment now available make it almost as economical to lay plant-mix in ½-in. thickness as to apply surface treatment. On secondary roads, surface treatment may be preferred because of the desire to place a larger amount of bituminous material for waterproofing.

Mechanical spreaders and pavers for bituminous pavement already are developed to a high degree of excellence, and future improvements are likely to be minor, with attention being given to new devices for controlling the edges. There will be changes, in compacting procedures, perhaps aided by vibratory equipment or changes in the rollers now being used.

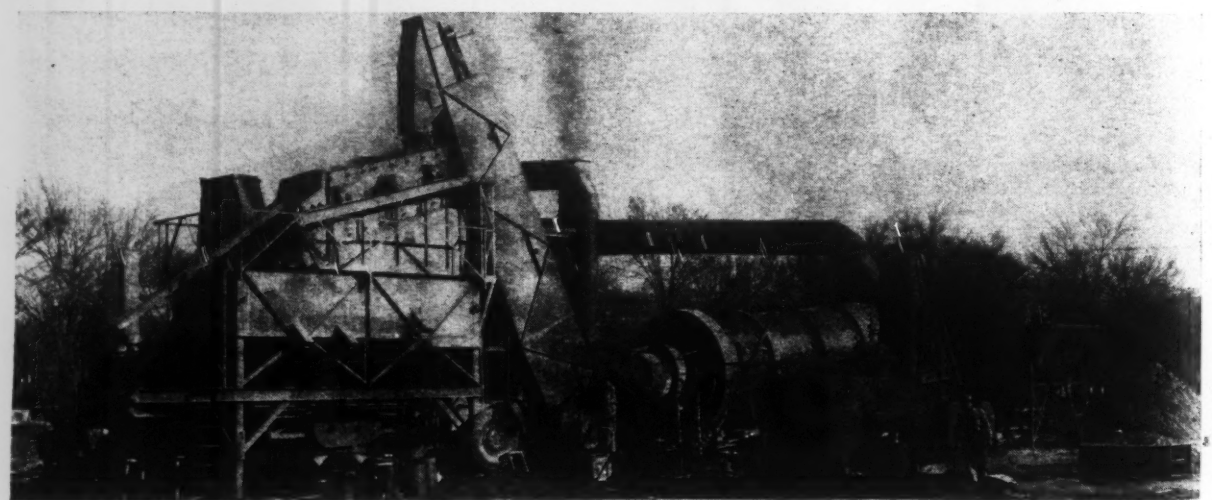
Pressure distributors on the market and in prospect for the immediate future have full-circulating spray bars of types which give clean, even starts and instant shutoff without drip. The distributors are designed for uniform controlled, rapid application of bituminous materials.

For compaction and consolidation of soils and subgrades, great efforts are being made both to discover the physical laws and to develop the machines for successful compaction. Manufacturers are experimenting with vibratory machines for this purpose, and some offer great promise.

The possibility of utilizing soil in place holds great opportunities for future construction both of better subgrades and of surfaces. Sand-asphalt roads are built successfully in place with sandy natural soils. Similar treatment of clay-type soils has been less satisfactory.

The rotary mixer, or tiller, has been vastly improved for pulverizing, aerating and mixing soil and soil mixtures. Equipped with auxiliary pump and spray bar, it can apply water or bituminous binder in controlled quantity from a tank truck. Several manufacturers make complete, self-propelled machines incorporating all these functions, and other manufacturers are experimenting with similar developments. A new machine, due to appear this summer, will spread bulk cement on soil-cement projects. Truck distributors were used for this during the war.

From what has been said about the great field for improvement and plans of manufactures it would seem that new equipment developments within a very few years might make current models obsolete. But careful analysis indicates that equipment purchased this year will be able to compete with future models for a long enough time to retire the investment.



Reliable, high-capacity, portable asphalt plants are largely responsible for the trend toward plant-mix bituminous pavement construction. This plant, equipped with a continuous mixer, has a capacity of 100-120 tons per hour.

MAJOR PROJECTS

That Are and Will Be Making Headline News

Brought together in this section are brief reports on the status of construction operations whose size and significance command national interest. For quick reference the individual projects have been grouped under a functional system of classification.

POWER AND IRRIGATION

MISSOURI VALLEY BASIN—During 1946 construction under direction of the Bureau of Reclamation was started on four major dams of the Missouri Basin plan. A $4,000,000 contract was awarded for Enders Dam on Frenchman Creek near Enders, Neb.; this is a rolled fill about 2,570 ft. in length and 100 ft. in height. About 60 miles southwest of Casper, Wyo., construction was begun on the 4,700,000 Kortes Dam on the North Platte River; this 200-ft. concrete gravity structure, two miles downstream from Seminoe Dam, will be built primarily for power production using three 12,000-kw. generating units. Angostura Dam, a $4,200,000 project for irrigation of 16,000 acres, was started on the Cheyenne River in western South Dakota; this will be a concrete gravity dam with a height of 150 ft. and a crest length of 1,900 ft. The Boysen project on the Big Horn River in northwestern Wyoming is the fourth dam that was started; this $8,000,000 project embraces irrigation, power production, flood control, and silt detention.

CENTRAL VALLEY PROJECT—Of the $384,300,000 total cost of the Central Valley project in California, some $171,000,000 has been expended. Biggest item on the current agenda is the rush job on two canals in the San Joaquin Valley—the 156 mi. Friant-Kern Canal and the 120-mi. Delta-Mendota Canal. Attention is also centered on construction of pumping works near Tracy; six 22,000-hp. pumps will be installed to lift 4,600 cfs. upward 200 ft. from the Delta Canal into the Delta-Mendota Canal.

Surveys have been completed for the Friant-Kern Canal to its terminus near Bakersfield, and some $15,000,000 of contracts are being executed on the first 75 mi. Delta-Mendota Canal operations are being pushed so that its completion will coincide with that of the Friant-Kern Canal. Contra Costa Canal is also nearing completion.

Two additional 75,000-kw. generators, loaned to Grand Coulee for the war, will be installed at Shasta Dam this year, and a fifth generator is being built. The dam's three drum-gates, which will raise the reservoir height to provide an additional 800,000 acre-ft. of storage, are scheduled for delivery this year.

At Friant Dam three drum-gates are being installed, and they will add 83,000 acre-ft. of storage. Construction of the stilling basin below the dam advanced in 1946. This reinforced concrete structure is about 440 ft. long, from 50 to 78 ft. wide and 35 ft. deep.

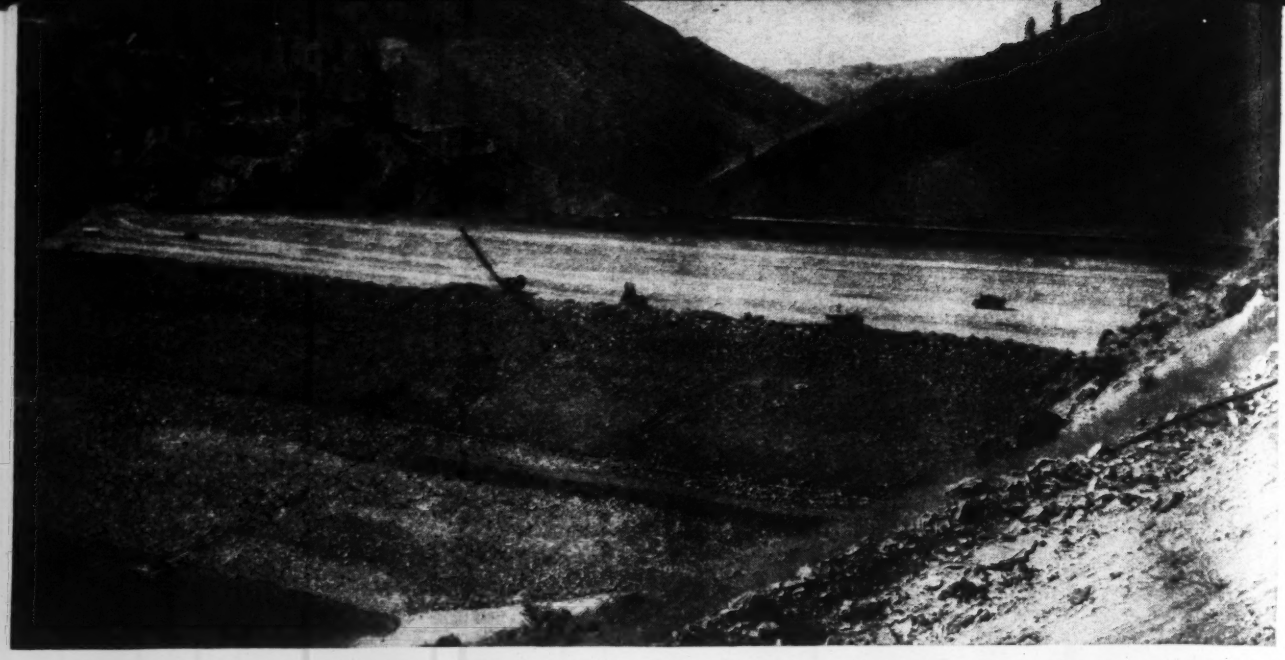
Construction of Mountain View Dam in California was begun last year. This structure is earthfilled, 50 ft. in neight and has a crest length of 1,200 ft. It will serve as an equalizing reservoir at the western terminus of the Contra Costa Canal near the town of Martinez.

DAVIS DAM—A $21,462,000 contract for construction of Davis Dam, fourth of the great structures for regulation of the Colorado River, was awarded in 1946 and work is going ahead. Located in Pyramid Cayon, 35 mi. west of Kingman, Ariz., the dam will be the largest construction project undertaken in the Southwest by the Bureau of Reclamation since it built Boulder Dam, located 67 mi. upstream. Total cost of the project, which is planned for power production and to regulate the flow of the river at the International Boundary in accordance with the Mexican Water Treaty, is estimated at $77,000,000. The dam, earth and rock-fill, will create a 1,820,000 acre-ft. reservoir. Five 45,000-kw. generators will be installed.

LUGERT-ALTUS PROJECT—With the 4-mi. Main Canal nearly completed work is being pushed on the 14.7-mi. Ozark Canal, the 11.5-mi. West Canal, and the 21.7-mi. Altus Canal, and the 3.2-mi. pipeline to supply the city of Altus, Okla. with additional water. Spillway gates for the crest of Altus Dam are being installed. A total of 52 mi. of main canal and about 300 mi. of laterals are involved and major contracts will be awarded in 1947 for this project, which is the first operating reclamation project in Oklahoma.

COLORADO BIG-THOMPSON PROJECT—The 13-mi. Continental Divide tunnel is completed altogether and some $31,480,000 has been spent on this $96,000,000 project. Shadow Mountain and Green Mountain dams also are virtually complete. Work has been started on five additional dams, all earth and rock-fill structures located in Colorado. A $6,000,000 contract has been let for Granby Dam on the Colorado River, about 5 mi. northeast of Granby; this structure has a height of 232 ft. and a crest length of 885 ft. It will be the main source of the water for the Big-Thompson project, which is designed to provide water for 615,000 acres in northeastern Colorado. From Granby dam, water will be pumped into Shadow Mountain Lake and then diverted through Grand Lake and the 13-mi. tunnel to the eastern slope of the Rockies. The four other dams started were—Horsetooth, Soldier Canyon, Spring Canyon, and Dixon Canyon. These structures will create Horsetooth Reservoir. Large contracts are also in progress for construction of the two large pumping plants to be built in the Estes Park area. The two plants will have a total installed capacity of 53,000-kw. Contracts totaling nearly $1,864,822 have also been awarded for the 1.3-mi. Rams Horn Tunnel and the 1.1-mi. Prospect Mountain Tunnel.

BOISE PROJECT—Anderson Ranch Dam



Highest earthfill in the world, Anderson Ranch Dam in Idaho has been virtually completed. Storage has already begun behind the 456-ft. structure, which will extend irrigation facilities on the Boise project.

is 96 percent complete, most of the 8,650,000 cu. yd. of rock and earth required having been placed. In one day last year (Sept. 18) a total of 20,680 cu. yd. of material was placed for this Idaho structure. Storage of water behind the 456-ft. dam, (highest earthfill in the world) has already begun, and construction has started on the powerhouse, which will have a final installed capacity of 40,500 kw. Cascade Dam on the Payette River is underway in accordance with a $1,400,000 general contract awarded last fall. This dam will be an earth and rock-fill structure 80 ft. high and 800 ft. long. The reservoir will have a capacity of 700,000 acre-feet.

COLUMBIA BASIN—Four major dams—Potholes, Long Lake, South Coulee and Hungry Horse—were begun in 1946 with additional big contract awards planned for 1947. Much work is also underway for the East, Low, Main and West canals. A $9,359,000 contract has been let for Potholes Dam, which will be built across Crab Creek 15 mi. west of Warden, Wash. This earthfill with a height of 200 ft. and a crest length of 19,000 ft. will provide a 615,000 acre-ft. storage.

Construction of Long Lake Dam, 2 mi. northeast of Stratford, Wash. at the south end of Long Lake Basin, is going ahead in accordance with a $1,770,592 contract. This earthfill will be about 1,900 ft. long and 111 ft. high. A $2,772,000 contract for South Coulee Dam calls for a 63-ft. earth and rock-fill dam to form the south end of the reservoir to be established in the Grand Coulee.

At Grand Coulee Dam installation has begun on the largest pumps ever built—six units each rated at 65,000 hp.; each motor will drive a centrifugal unit capable of lifting 1,350 cfs. to a height of 310 ft.

Construction is progressing on the 2-mi. Bacon Tunnel, which will be 23 ft. in diameter. Many miles upstream Hungry Horse Dam was begun in Montana on the Flathead River to regulate the flow above Grand Coulee Dam. A $48,000,000 project, which is being handled separately from what the bureau calls its Columbia Basin project, it will provide water for 100,000 acres.

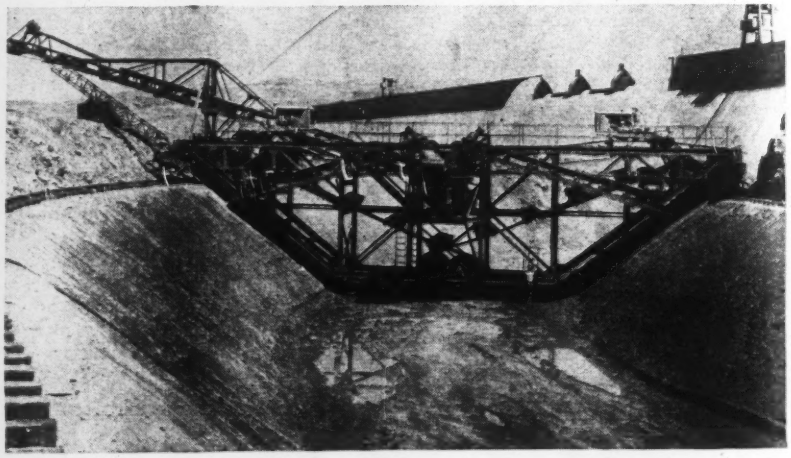
ROSS DAM—Progress on this project, being built by Seattle for power development on the Skagit River, is now progressing in the second stage of development which raises the dam from El. 1,365 to a level varying from 1,525 to 1,555. Plans and specifications for the third step that will raise the crest to El. 1,615 are now being prepared and bids may be invited in March.

PROVO RIVER PROJECT—Important elements of this 95,000-acre project are under construction. More than half-completed is the 41-mi. Salt Lake aqueduct to carry water from Deer Creek Reservoir to Salt Lake City. Also under construction are: Weber-Provo Canal, Duchesne Tunnel, and Provo Reservoir Canal. A power plant at Deer Creek Dam will also be built.

ALL-AMERICAN CANAL—Virtually all of the 145-mi. Coachella branch of the $70,000,000 All-American Canal project in California is complete. Work was also advanced on the Coachella Valley distribution system.

DESCHUTES PROJECT—Over 11 mi. of the 65-mi. North Unit Main Canal is under construction for irrigation of 50,000 acres near Madras, Ore. Wickiup Dam, an earth and rockfill 100 ft. high and 14,000 ft. long, is almost finished.

TUCUMCARI PROJECT—About $10,000,000 has been spent on this $14,800,000 New



Canal-trimming machine in action on the Friant-Kern Canal, one of the major elements in the Central Valley project in California.

Mexico project. With the Conchas Canal almost complete work is being pushed on the 16.8 mi. Hudson Canal.

PRIVATE UNDERTAKINGS—In addition to U.S.B.R. power projects, private agencies in the Western states are developing power, both steam and electric, to meet demands resulting from population growth. Working on a 2- or 3-year programs because of the time required for delivery of equipment, power companies have laid out a 30 percent increase in output to be operative within a 3-yr. period, as listed in the accompanying table.

In the Northwest the new power will be entirely hydroelectric. In the Pacific Southwest and in Colorado more than a million kilowatts will be added in steam plants. The largest Western developments will be on the system of the Pacific Gas and Electric Co. with a total of 379,000 kw. of additional capacity to be completed by the end of 1948. Of this amount 260,000 kw. will be in steam and 119,000 kw. in hydroelectric units.

The Southern California Edison Co. has a 1947 betterment budget of $52,000,000, included in which will be two 60,000-kw. steam units in the new Redondo Beach station to be ready for operation in the latter part of the year, with space provisions for doubling the capacity. Another item will be a new 35,000-kw. hydro unit in the Big Creek No. 3 powerhouse to be in operation late this year.

PRIVATE POWER COMPANY PLANS

	New Power (Kw.)
Pacific Gas and Electric Co.	379,000
So. California Edison Co.	275,000
Los Angeles Bureau of Power & Light	290,000
San Diego Gas & Electric Co.	50,000
City of Pasadena	35,000
City of Burbank	20,000
City of Glendale	20,000
Central Arizona L. & P. Co.	33,000
California Oregon Power Co.	40,000
Idaho Power Co.	85,000
Public Service Co. of Colo.	47,000
TOTAL	1,273,375

MUNICIPAL WATER SUPPLY

SAN DIEGO, CALIF.—To deliver Colorado River water to San Diego, a 71.1-mi. aqueduct costing about $13,000,000 is now 65 percent complete. Contracts awarded during 1946 and amounting to $2,887,000 include supply line and filtration plant equipment. Bids will be asked this year totaling $4,250,000 on supply mains, a 66-mgd. plant, and 20 mg. reservoir.

MOKELUMNE AQUEDUCT — Contracts have been let for 33 mi. of the new Mokelumne Aqueduct for the East Bay Municipal Utility District. This supplementary 82-mi. line will cost about $22,000,000. Other work under way includes six new pre-stressed concrete reservoirs and expansion of two filtration plants.

SEATTLE, WASH.—A $1,400,000 water supply improvement program will include a 1-mg. elevated tank, a 48-in. steel supply line, extensions of the distribution grid and a concrete lined 5-mg. reservoir.

PHOENIX, ARIZ.—Under contract is one-fourth of a $6,000,000 program to augment the city's water supply. The work includes spillway gates on Horseshoe Dam; a 30-mgd. pump and filter plant; additional booster pumps; construction of a 20-mg. reservoir and 8 mi. of 48-in. pipeline.

BOSTON, MASS.—Costing over $500,000, two shafts on the proposed 5½-mi. extension of the Hultman aqueduct are now being sunk preliminary to the principal contract letting which will probably take place this spring. The tunnel, 12 ft. in dia. and entirely in rock, will bring the aqueduct into the metropolitan area, permit high pressure connections to existing mains, reduce pollution hazards, and eliminate pumping. Also, a high-level reservoir to provide better water service in areas south of Boston and an aqueduct siphon to replace a bridge crossing are planned for this year. Two power plants will be built to utilize available head.

SAGINAW - MIDLAND, MICH.—Largest water supply system under construction in the Middle West was started in September with award of contracts aggregating $10,300,000. Comprising the project are an 81 mi. prestressed reinforced concrete pipe line, an intake at Whitestone Point on Lake Huron, and two 72 mgd. pumping stations. Connection to the system is under consideration by Flint, Mich., as one of the schemes for augmenting that city's supply at a cost of $24,000,000.

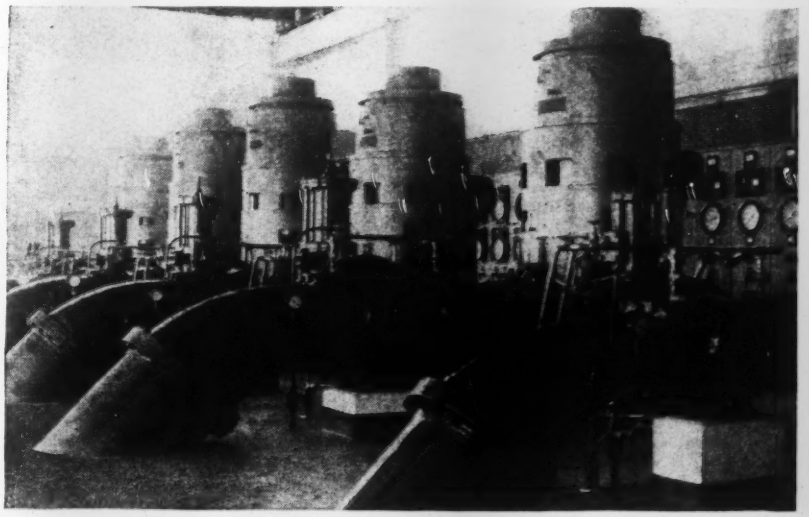
KANSAS CITY, MO.—Construction will be started soon on $2,000,000 of water distribution mains. New pumping stations call for an expenditure of $1,000,000; 35 percent of this work is in progress. The remainder will be contracted this year.

CHICAGO, ILL.—Delay in obtaining wash-water pumps is the principal factor preventing completion and operation of Chicago's $24,000,000, 320-mgd. South District water filtration plant. At the end of the year, the plant was 90 percent complete.

PHILADELPHIA, PA.—About $12,000,000 will be spent during 1947 for the installation of ozonation equipment—the largest of its kind in the United States—at the Belmont filtration plant. It is expected to be in operation by 1948. Action on plans for development of upland sources (*ENR*, Jan. 24, 1946, vol. p 138 and Dec. 4, 1946, vol. p. 176) depends upon a selection of recommendations, probably by public referendum. Contracts in force for waterworks improvements total $7,000,000.

BALTIMORE, MD.—Development of the Patapsco River water supply system will be started this year. Bids will be taken soon on the construction of a hard rock tunnel, seven miles long, extending from the Montebello filter plant to the city limits.

To provide more reliable water service in the Brooklyn-Curtis Bay-Fairfield area, construction of a 48 in. sub-aqueous main carried across Baltimore harbor on an underwater trestle supported on piles will be undertaken this year. Bids will be solicited immediately upon receipt of federal au-



Houston's development of the Southwest well field includes six high-lift electric-driven pumps to produce initially 30 mgd. from six wells.

San Diego's 96-in. reinforced concrete aqueduct that will bring water from the Colorado River will be completed this year. Wellpoints were used to solve groundwater difficulties.

thority to cross the Fort McHenry reservation. The project estimated at $2,250,000, involves a total of about a mile of 36 in. connections on both sides of the harbor, a 30-in. tie-in at Fort McHenry, and nearly 9,000 ft. of 48 in. underwater crossing.

HOUSTON, TEX.—Costing about $1,000,000, initial development of the southwest well field includes six high-lift, turbine-electric pumps ranging in capacity from 4,000 to 9,100 gpm. and four 600 hp. standby, diesel-powered generator sets; these units will draw 30 mgd. from six wells, but to meet future demands the system is designed to produce 48 mgd. from sixteen wells. Arterial mains completed during the past year cost $3,000,000; an additional $1,000,000 program is under way. To supplement the ground-water supply the San Jacinto River project will be developed: the West Canal will be enlarged, lined and extended to a filter plant, and transmission mains from the plant will be built, all at an estimated cost of $3,500,000.

NEW YORK CITY—The Board of Water Supply has resumed construction on Merriman Dam and extension of the system to bring water to New York from the East Branch of the Delaware River. The 85-mi. tunnel to Merriman shut down in favor of war work is now being completed. A deep cut-off wall to rock was completed but little of the 7,000,000 cu. yd. of rolled-filled was placed in Merriman Dam. The dam was relet in March '46 but only 3 percent of the work was completed this season. The cut-off wall at Neversink Dam is being sunk under a $4,076,000 contract. It is probable that contracts will be let this year for construction of the rolled-fill Neversink Dam, the seven mile tunnel to Neversink, possibly the stream diversion and cut-off wall for Downsville Dam, and various protective sewage treatment facilities. Total work planned for contract in 1947 amounts to $40,000,000.

NEW ORLEANS—A large main nearly nine miles long, consisting of 24 to 48 in. pipe and of either cast-iron or coated and lined steel, will be advertised by the Sewerage and Water Board in 1947. Costing about $2,300,000 the project will require one year for completion. Improvements at the waterworks plant consisting of boilers, boiler foundations, and coal pulverizers valued at $845,850 are ten percent complete. In addition about $500,000 will be required for superstructures.

SEWERAGE

CHICAGO, ILL.—The Sanitary District awarded contracts valued at $11,830,500 for sewers and $6,636,790 for treatment facilities during 1946. The Harms Road outfall is 80 percent complete but the other projects, started late in the year, are barely underway. A major award for improvements at the West-Southwest treatment works is valued at $5,421,900. If conditions are favorable for taking bids, provisions in the 1947 budget will permit construction of additional facilities estimated at $20,000,000. The city's Bureau of Sewers has completed plans for new sewerage immediately south of the downtown business section, estimated to cost $2,000,000. A program totaling about $100,000,000 for additional sewerage improvements is now in progress.

NEW YORK CITY—Seven of the seventeen plants to serve this city are in operation, treating some 496 mgd. Plans for the 140-mgd. Newton Creek, the 160-mgd. Owl's Head and the 10-mgd. Port Richmond plants are well advanced, and bids will be received soon to add secondary treatment to the 60-mgd. 26th Ward plant, and for complete treatment projects at Rockaway (15 mgd.) and Hunts Point (120 mgd.). Economic conditions permitting, construction of these units will be started during 1947 and 1948.

LOS ANGELES, CALIF.—Under impetus of court action by the State Department of Public Health, preliminary work has been started at Hyperion on the construction of a 250-mgd. activated sludge plant. Low bid for a chlorination and bar-screen building was $1,376,804. Other commitments in 1946 were a $3,500,000 contract for removing 14,100,000 cu. yd. of sand from the site and another $3,500,000 contract for construction of a new outfall.

SAN FRANCISCO BAY AREA.—San Francisco will undertake to increase the capacity of one treatment plant from 10 to 20 mgd. and to plan additional treatment facilities for a daily flow of 65 mgd. Officials of the East Bay Municipal Utility District hope to begin construction this year on a $22,000,000 program including a

treatment plant, three main intercepting sewers and an outfall. These facilities will replace some 42 outfalls now discharging raw sewage on the East Bay.

STOCKTON, CALIF.—Bids will be called for a $2,000,000 sewage treatment plant having a capacity of 20 mgd. and including primary and secondary sedimentation, sludge digestion and high-rate filters.

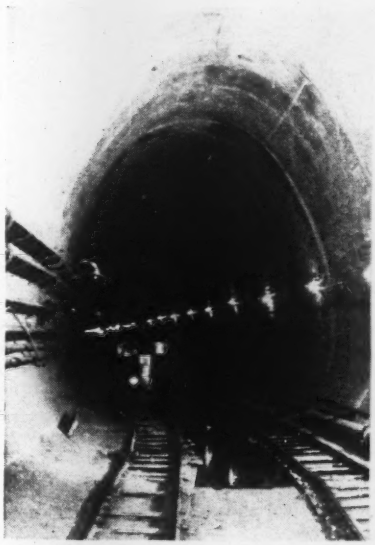
BOSTON, MASS.—Contracts totalling nearly $3,000,000 have been let for the construction of the $5,000,000 sewage disposal plant at Nut Island; lettings will be completed this year. Designs for a similar treatment station at Deer Island, north district, are in preparation. To reduce pollution a $1,000,000 storm sewer for which contracts are now being prepared will be built along Alewife Brook.

PHILADELPHIA, PA.—Plans call for the construction of three plants, the Northeast, Southwest and Southeast—each with a capacity of about 135 mgd. Bids for the northeast plant, which will replace a 60 mgd. Imhoff tank installation, will be taken this spring. Preparation of plans for the other plants are well advanced and work will probably be started early next year. Interceptors now under construction will be completed in time to serve the new treatment stations. A bond issue for $42,000,000 has been authorized but rising costs will probably demand an additional $20,000,000 to complete the work.

BALTIMORE, MD.—A sludge dryer to be erected at the Black River plant will cost about $600,000. Construction of two covered, sludge digestion tanks, and the installation of 30 rotary distributors on existing trickling filters to increase the capacity from 3 to 4 mg. per acre per day are covered by contracts already let and amounting to nearly $1,200,000. To provide sanitary and storm sewers in conjunction with new streets, about $1,250,000 has been set aside, and to start the Jones Falls trunk sewer, an initial appropriation of $500,000 has been made out of a possible total cost of $2,000,000.

NORTHERN INDIANA—The Carbide & Chemical Corp.; Standard Oil of Indiana; United States Lead Refinery; Shell Oil Co., American Maize Products Co.; Inland Steel Co.; and Sinclair Refining Co. have filed stipulations with the Indiana attorney general setting out their contributions for control of pollution in Lake Michigan in the East Chicago, Hammond and Whiting districts of Lake County; twelve more companies have announced intentions of submitting plans in the near future. Construction costs will total about $15,000,000.

PORTLAND, ORE.—Bids will be invited again this spring on the first unit of Portland's project for discharging sewage into the Columbia River. (Bids received last year were rejected as too high.) Design has been completed on 70 percent of the project, now estimated to cost $14,500,000 instead of $12,000,000, the amount of the 1944 bond issue. This deficit can be made up without additional bonds by increasing the sewer-user charge to 33 percent of the water bills, an increase that has already been approved.



Twenty-five feet underground, the first section of the east branch of the Chicago Sanitary District intercepting sewer, 20 ft. high, 18 ft. wide and 17,000 ft. long, will relieve periodic flooding.

BUILDINGS

VETERANS ADMINISTRATION HOSPITALS—Nearing completion: 477-bed, $3,000,000 hospital at Lebanon, Pa., and 1,172-bed $5,000,000, structure, Tomah, Wisc. Under contract, with supervision, furnished by Army Engineers: 1,000-bed building, Buffalo, N. Y., 400-bed project, Providence, R. I., 300-bed general medical hospital, Sioux Falls, S. D., and 1,984 bed neuropsychiatric, Peekskill, N. Y. Additions under way: 15, totaling 5,000 beds.

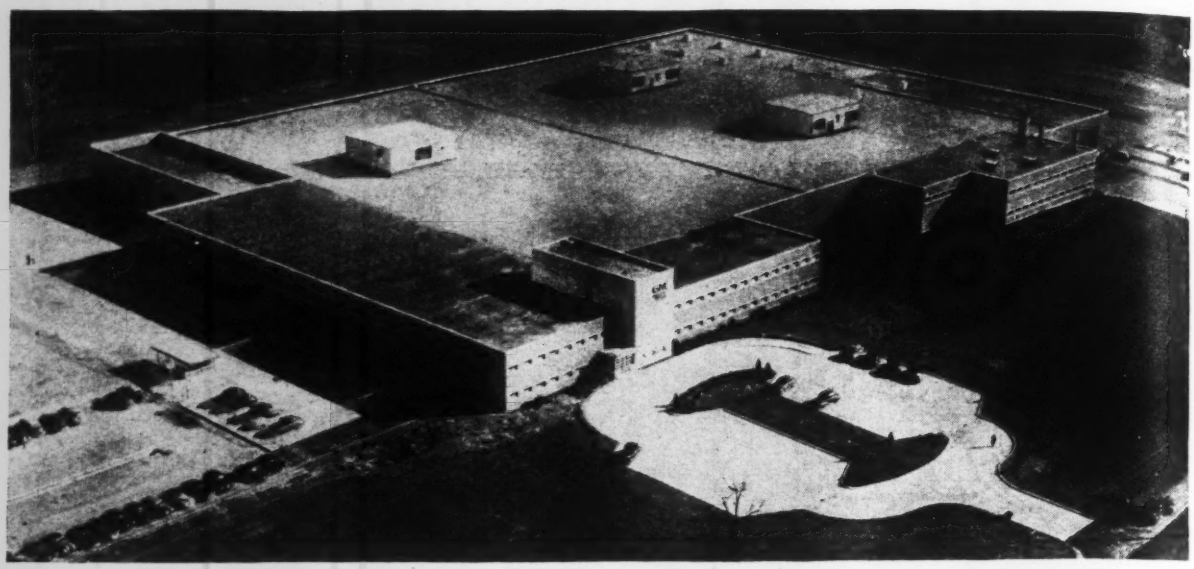
CHICAGO HOUSING—Now being erected are two privately financed developments employing 8-in. thick, reinforced brick walls, recently made permissable by a code revision. One consists of 35 six- and eight-story buildings to cost about $6,500,000 for 840 negro families and the other of 11 structures with 164 apartments at about $1,250,000.

NORTHERN ILLINOIS HOUSING—Guaranteed-mortgage financing by the Federal Housing Administration for multiple-dwelling housing projects on Jan. 13 totaled $3,067,400 for 14 projects containing 420 apartments, which are from 2 to 98 percent complete. Commitments of $4,502,000 have been issued for eleven additional developments, providing 621 units, but construction is not under way.

METROPOLITAN LIFE INSURANCE CO., N. Y.—Three developments in Manhattan, containing 12,482 apartments, are well advanced. To house 8,755 families, 35 twelve- and thirteen-story buildings are being built at Stuyvesant Town, steel for five having been completely erected and for four being bolted. At Peter Cooper Village 2,495 families will soon be quartered in 21 fifteen-story structures, and the greater part of Riverton, seven thirteen-story residences of 1,232 apartments, are also well on the way to completion.

NEW YORK LIFE INSURANCE CO.—Starts on two developments and purchase of a site for a third mark the entry of this company in housing. Some of the 150 garden-type apartments have already been occupied in the Princeton, N. J. Stanworth group, which consists of two- and three-story brick and frame buildings

Nearing completion, the New York City Housing Authority's concrete-frame Elliott Houses will feature the use of brick cavity walls for enclosure.



Completed last year, this 138,000-sq. ft. plant is manufacturing fuel injectors for the Diesel equipment division of General Motors Corp.

occupying less than 16 percent of a 17-acre tract. Two thirteen-story concrete structures are well advanced at Fresh Meadows in Queens, N. Y. and these will be followed by one-, two- and three-story dwellings to furnish a total of 3,000 apartments, a community center, shopping facilities, theatre, playgrounds, and garages, all occupying less than 20 percent of the 170-acre tract.

NEW YORK CITY HOUSING AUTHORITY—Farthest advanced of six large projects are the $3,600,000 cavity-wall John Lovejoy Elliott Houses, consisting of two eleven-story and two twelve-story concrete structures containing 608 apartments, construction on which started last January and which was ready for some occupants in December. Concrete frames are rising for the $10,000,000 Brownsville Houses, which will shelter 1,338 families in 27 three- and six-story buildings, and for the $10,000,000 James Weldon Johnson apartments, which will provide 1,310 units in ten six- to fourteen-story structures. Also under way are Abraham Lincoln Houses at $10,300,000 for 14 six- to fourteen-story steel frame residences for 1,286 families, Marcy Houses at $14,500,000 for 27 six-story concrete dwellings for 1,141 families and Jacob Riis Houses containing 1,768 apartments in 19 six- and 13-story concrete buildings.

Department stores will occupy the lower seven stories of the air-conditioned Plaza Terrace Hotel, in Cincinnati. Hotel lobby will be on the eighth floor.

ELECTRONICS PARK—General Electric Co.'s $10,000,000 research laboratory and manufacturing center for electronic devices at Syracuse, N. Y. is now 70 percent complete. Laid out and landscaped like a college campus, the project has a two-story laboratory and office building backed up by a one-story factory for each of three main units. General Electric forces now are moving into the transmitter unit, the receiver unit is 80 percent complete, the specialty unit is 60 percent, and smaller buildings 25 to 40 percent finished. All structures are enclosed.

MICHIGAN PROGRAM—The state's five-year building program including repair, maintenance and fire protection of existing plant as well as new structures and additions, adopted in 1944 and estimated to cost $63,055,000 based on 1940 prices now is expected to cost $143,000,000. Funds totaling $51,860,000 have been appropriated and projects now under construction total $37,200,000. All projects in the $143,000,000 program are expected to be placed under contract before 1948.

CATERPILLAR TRACTOR CO.—Expansion at Peoria, Ill., is adding about 41 acres of floor space, an increase of 50 percent, involving expenditure of $30,000,000. The structural frame of the largest building,

housing 925,000 sq. ft. for diesel-engine manufacture, is being erected. Other buildings under way include 400,000 sq. ft. for tractor manufacture, 150,000 sq. ft. for parts and 250,000 sq. ft. for maintenance and other activities.

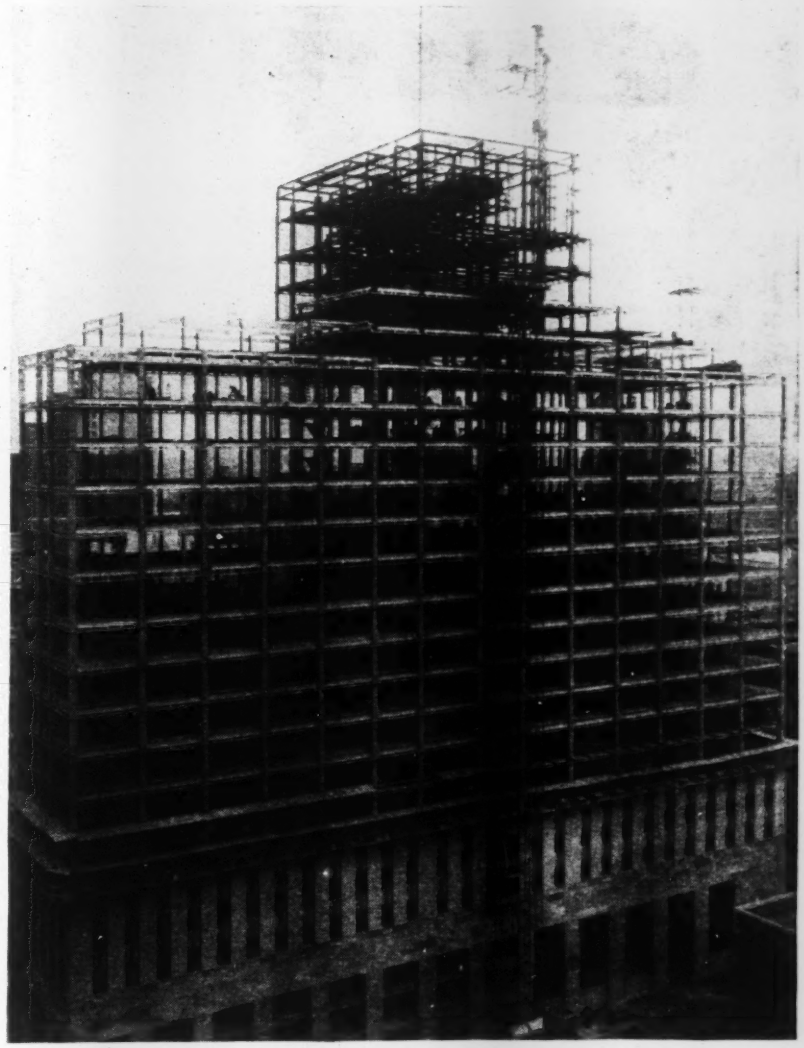
E. I. DU PONT DE NEMOURS & CO.—Under way in and near Wilmington, Del., are a 2½-story, brick-faced, concrete addition to the Jackson Laboratory and enlargement of the synthetic detergents plant at Deepwater Point, N. J., a new wing at the Carothers Research Laboratory, Experimental Station, Wilmington, and expansion of the pigments department, Edgemoor, Del. Plants for increasing nylon output are being erected at Chattanooga, Tenn.; Sabine River Works, Orange, Texas; and Niagara Falls, N. Y.; and for plastics at Washington Bottom, near Parkersburg, W. Va.; for chemical specialties at West Toledo, Ohio; and for precipitated pigment colors at Newark, N. J.

GENERAL MOTORS CORP.—Large-scale activities in the various divisions include: Brown-Lipe Chapin division—one-story, 378,000-sq. ft. stamping plant, Elyria, Ohio; Buick division—four-story sheet metal plant, with 900,000 sq. ft. of floor at Flint, Mich.; Buick-Olds-Pontiac assembly division—one-story, 965x1,145-ft. building, Framingham, Mass.; one-story, 955x1,055-ft. structure, Atlanta, Ga., and three-story plant with 1,300,000 sq. ft. of floor, Wilmington, Del.; Chevrolet division—one-story, 1,250,000-sq. ft. assembly plant, Flint, Mich., expansion of press metal shop and a new office building, totaling 350,000 sq. ft., Indianapolis, Ind., and one-story, 1,000,000-sq. ft. assembly plant, Van Nuys, Calif.; Fisher Body division—two-story assembly building with 435,000 sq. ft. of floor, Flint, Mich., 912,000-sq. ft. hardware factory, Columbus, Ohio, and 2,158,000-sq. ft. stamping plant, Hamilton, Ohio; GMC Truck & Coach division — one-story, 720x540-ft. coach assembly plant; New Departure division — 753,250-sq. ft ball-bearing factory, Sandusky, Ohio.

ESSO BUILDING, NEW YORK—Steel for all-air-conditioned, 424-ft. high, 33-story addition to Rockefeller Center is being topped out. Containing 350,000 sq. ft. of rentable area, the $6,000,000 limestone-faced, T-shaped structure is expected to be completed this fall. A central tower, 90 ft. wide and 127 ft. deep will rise without setbacks to the 424 ft. height.

TRIBUNE TOWER, CHICAGO—Field-welded, the steel frame of the $4,000,000 ten-and-12-story printing addition to the Tribune group at last reports had been erected up to the third story. The frame requires about 3,000 tons of steel, and the new building adds 2,250,000 cu. ft. to the Tribune group.

HOUSTON, TEX.—Shop-fabricated and field-erected using electric-welding, the steel frame of the $5,000,000 24-story City National Bank Bldg. has been completed and walls built to more than half the height. Work is under way on the $4,500,000 reinforced concrete Foley Bros. department store and the first unit of the new Medical Center—the reinforced-concrete Baylor Medical College, costing over $1,000,000.



All-welded, the steel frame of the City National Bank Building in Houston, Tex., rises 18 stories above three boundary streets, with a central tower 24 stories high.

TERRACE PLAZA HOTEL, CINCINNATI—Expected to be completed this fall, the $12,000,000 air-conditioned 18-story structure (steel erected to 16th story at last reports) will be windowless from the second to the eight floor, this section being devoted to commercial activities. The hotel lobby, served by eight high-speed elevators, will be located on the eighth floor. Uncommon is the use of the 2x4x12-in. terra-cotta color brick, laid with continuous vertical joints, for exterior facing.

BOSTON, MASS.—About 1,600 steel H-piles have been driven and a 10-ft. thick mat is being cast for the $14,000,000, 26-story John Hancock Mutual Life Insurance Co. offices, delayed by government restrictions but expected to be the tallest building in the city when completed.

SAN FRANCISCO NAVAL SHIPYARD—Facilities being added at Hunter's Point include two 450-ton bridge cranes, two 1,400-ft. berthing piers, $3,000,000 glass-walled ordnance building and three others totaling $7,000,000. At the Navy's Inyokern desert research center, $6,000,000 of work is still not completed.

UNDERGROUND GARAGE, DETROIT—Initial contracts may be awarded in July, for Detroit's parking garage under Washington Blvd. Present plans are for a two-level, 740-car garage under one-half the length of the 1,500 ft. long by 195-ft. wide section of boulevard between Grand River and Park avenues. Each parking deck will be 155 ft. wide, with column rows spaced about one-third of that width,

permitting four rows of cars with no columns in either of the two access isles. Cars will be parked at an angle to the isles, and access to the decks will be by circular ramps and concrete stairs from street level. Estimated cost is $3,150,000.

JOHNS-MANVILLE—Part of a $50,000,000 expansion program, a 40,000-sq. ft. one-story steel-and-concrete structure for manufacturing asbestos insulation will be completed this year at Tilton, N. H.; a 300,000-sq.ft. factory for insulating board at Natchez, Miss., is planned for completion early in 1948; and a plant for rock wool and asbestos-cement pipe has just been placed under construction at Toronto, Canada.

FLOOD CONTROL FACILITIES

MISSOURI RIVER BASIN—Highway and railroad work costing about $5,000,000 for Garrison Dam in North Dakota has been awarded. The structure contains 75,000,000 cu. yd. of embankment, or more than four times the volume of the largest rolled-fill dam constructed to date. Other projects in the basin are:

Fort Randall Dam—Work has started on this 160 ft. high earthfill in South Dakota which will have a crest length of 10,000 ft. The project is on the main stem of the Missouri.

Cherry Creek Dam—A general contract for this $18,000,000 rolled earthfill has been awarded. The location on Cherry Creek—tributary of the South Platte River—is a few miles south of Denver, Colo.

Kansas City—Contracts are being executed on flood walls and other protection works. Additional protection for the Kansas City area is provided by the 120-ft. earthfill Kanopolis Dam on the Smoky Hill River, which is nearing completion, and by the construction of Harlan County Dam on the Republican River in Nebraska. This structure, contracts for which have been awarded, is an earthfill with a height of 106 ft.; it will cots $36,000,000.

Omaha and Council Bluffs—Protective levees for these cities costing $10,000,000 are under construction.

WILLIAMETTE RIVER, ORE.—Three large projects—Detroit, Dorena, and Lookout Point dams—are now going ahead as part of this development. Road relocation has been awarded for the first two structures and soon will be started for the third. The $35,000,000 Detroit Dam, located 60 mi. above the mouth of the North Santiam River, will be a concrete gravity structure 370 ft. high. Expected to cost $10,000,000 Dorena Dam is on the Row River above Eugene, Ore.; it is an earthfill 140 ft. high and 4,560 ft. long. Lookout Point Dam, an earthfill 200 ft. high and 3,000 ft. long, is on the Middle Fork River 22 mi. southeast of Eugene; it will cost $37,000,000.

BUFFALO BAYOU, TEX.—Barker Dam reservoir has been completed as part of this $25,000,000 project and Addicks Dam was started in 1946. Construction of the third unit—White Oak Dam—will probably not begin until 1948. All structures are low earthfills. Planned to provide protection for the Houston ship canal area, the project also includes several miles of diversion canals.

ST. LOUIS DISTRICT—Projects involving about 70,000 cu. yd. of earthwork on the Mississippi River are under way. Extensive drainage structure construction will follow. Bulk of the work is on the east side of the Mississippi from East St. Louis, Ill., to Cape Girardeau, M.

LOWER MISSISSIPPI—Four flood control dams, extensive bank protection at Shreveport, La., and a backwater protection project near the mouth of the Red River is underway in the Vicksburg District. In all, $46,000,000 of work is planned.

Enid Dam—A $10,000,000 rolled earth dam on the Yacona River, about 12 mi. south of Batesville, Miss., will be started in 1947. The dam will be 86 ft. high and 8,500 ft. long.

Grenada Dam—This is another earthfill dam to be started early in 1947. Costing $17,000,000, the dam will be 14,100 ft. long and 80 ft. high. Location is east of Grenada, Miss. on the Yalobusha River.

Narrows Dam—This $9,000,000 multipurpose concrete dam, 941 ft. long and 188 ft. high on the Little Missouri River near Murfreesboro, Ark., is under construction.

Bayou Bodeau Dam—Calling for a rolled fill dam 70 ft. high and 8,400 ft. long, this $3,000,000 project will be started this year. Location is on the Bayou Bodeau River near Bellevue, La.

Memphis District—Work has started on protective works for Memphis with flood wall construction already underway.

New Orleans District—Construction is being finished on the Bayou Sorrell lock 15 mi. south of Plaquemine, La., to provide closure for an existing navigation opening in the east guide levee of the East Atchafalaya basin protection levee. Some 5,000,000 cu. yd. of channel excavation south of Alexandria, La., is planned.

ARKANSAS RIVER—Six dams are under construction in this basin. They are Canton Dam near Canton, Okla., on the North Canadian River, and which is expected to cost $10,000,000; the $32,000,000 Fort Gibson Dam on the Neosho River; Blue Mountain Dam on the Petit Jean River near Danville, Ark.; Wister Reservoir across the Poteau River above Wister, Okla.; Fall River Dam on the stream of that name and located above Fall River, Kans.; and Hulah Reservoir, a $9,000,000 Caney River project about 15 miles above Bartlesville, Okla. Tainter gates for the crest of John Martin Dam on the main stem of the Arkansas River near Lamar, Colo., are being installed to complete this $15,000,000 project.

Flood control on the New River in West Virginia will be aided by Bluestone Dam, a concrete gravity structure that will be 165 ft. high. Ultimate cost of the dam, which is about 60 per cent complete, will be more than $26,000,000.

WHITE RIVER—Construction of the $11,000,000 Clearwater Dam on the Black River near Piedmont, Mo., an earthfill structure 154 ft. high is well advanced. Preliminary work has been started on the $57,000,000 Bull Shoals Dam, a 278 ft. high concrete gravity structure on the White River itself. Bids on the main dam contract were rejected.

OHIO RIVER BASIN—Construction of Center Hill Dam on the Caney Fork River of the Cumberland watershed 55 mi. above Nashville, Tenn., has been resumed, this $33,000,000 project having been shut down during the war. The work calls for a 246-ft. high, 870,000 cu. yd. concrete dam with a 2,500,000 cu. yd. earthfill end section. Completion is scheduled for 1948.

Bluestone Dam—More than $10,000,000 has been appropriated for this job, which was curtailed by the war. This 165 ft. concrete dam on the New River upstream from Hinton, W. Va., will provide flood control on the New and Kanawha Rivers for protection of the Charleston, W. Va., area. Ultimate cost will be more than $26,000,000 when completed in 1948.

Wolfcreek Dam—Shut down during the war, this $59,000,000 Ohio Basin project calls for construction of a 240-ft. high concrete dam on the Cumberland River. Excavation is underway and two 2,300 ft. cableways are ready for start of concreting this spring.

Dillon Reservoir—Highway and railroad relocation work for this reservoir on the Licking River 6 mi. above Zanesville, Ohio, has been started. A rolled filled dam 118 ft. high and 1,350 ft. long, it will cost about $14,000,000.

Conemaugh Dam—Railroad relocation contracts are being executed for this $33,000,000 project on the Conemaugh River near Tunnelton, Pa. The dam will be a concrete gravity structure with a crest length of 1,290 ft. and a height of 137 ft.

Parkersburg, W. Va.—Levee and floodwall work, including a pumping station, is well advanced. Total cost is $4,000,000.

Louisville, Ky.—A sum of $1,000,000 for flood control along the Ohio River is available and two sections of protective wall are ready for award. Altogether, some $17,000,000 of work is planned.

Cannelton, Ind.—Flood protection for this Indiana town about 50 mi. downstream from Louisville calls for the construction of floodwalls and pumping stations with the total cost estimated at $2,000,000. Some work is underway and major contracts may soon be awarded.

ALLATOONA RESERVOIR—Construction of the main dam for this $27,000,000 project in Georgia has been started. A concrete dam 190 ft. high is being built on the Etowah River to provide flood control, navigation and power production in the Coosa River basin.

CLARK HILL DAM—The highway relocation for this $45,000,000 project has been started but bids taken Jan. 17 for the concrete gravity structure and powerhouse on the main stem of the Savannah River 22 mi. above Augusta, Ga., have been rejected. Flood control, navigation and power production benefits will result.

Levee enlargement on the Arkansas River under direction of the Vicksburg Engineer District involves movement of 2,300,000 cu. yd. of material.

Finishing touches are put on TVA's Fontana Dam in western North Carolina, fourth largest and highest concrete structure in the world. Visitors' building and parking area are under construction. Spillway, under road at right, discharges excess water through tunnels at the abutment rather than down the face of the dam.

BUGGS ISLAND RESERVOIR—Extensive highway relocation has begun and the dam itself may be awarded in 1947. The $57,000,000 flood control and power project calls for a concrete gravity and earthfill dam 150 ft. high on the Roanoke River in Virginia.

DELAWARE RESERVOIR—Expected to cost $5,000,000, construction of this reservoir on the Olentangy River a few miles north of Delaware, Ohio, has been started with the award of the necessary highway work as well as the dam itself. An earthfill dam 92 ft. high with a concrete-gravity spillway section is planned.

SUSQUEHANNA RIVER—At Williamsport, Pa., work has been started to complete flood walls on both banks of the Lycoming Creek and the west branch of the Susquehanna at a cost of $10,000,000. An early start on construction of Almond Dam, a $5,500,000 earthfill on the Cana-

cadea Creek in Steuben County, N. Y., is expected; the dam will have a height of 90 ft., and a crest length of 1,260 ft.

CONNECTICUT RIVER—Union Village Reservoir, a 170 ft. earthfill dam on the Ompompanoosuc River in Vermont has begun. Estimated cost is $3,700,000.

MANSFIELD HOLLOW RESERVOIR—Work will start this year on an earthfill dam 68 ft. high and 12,000 ft. long on the Netchang River near Willimantic, Conn. Estimated cost is $5,800,000.

MOUNT MORRIS RESERVOIR—Located on the Genesee River in New York, above the town of Mt. Morris, this $15,000,000 job will start this year. A concrete gravity dam 232 ft. high is planned.

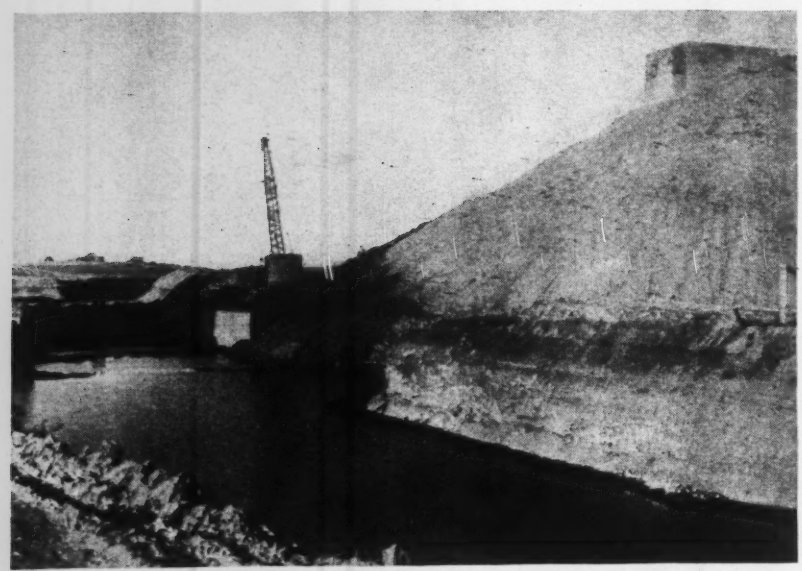
SACRAMENTO RIVER BASIN—Started a number of years ago, work this year will be carried forward by the award of contracts for the construction of levees and bypasses at a number of locations. About $2,000,000 is available for new work.

TENNESSEE VALLEY AUTHORITY—TVA's 1946 construction activities were relatively modest. Final clean-up operations and installation of public facilities at Fontana and Kentucky Dams continued throughout the year and are nearly complete; grouting at Great Falls Dam (acquired by TVA in 1939) was completed at mid-year, effecting a stoppage of 450 cfs. of water loss. Work on Watauga, a 318-ft. high rock-fill dam and South Holston, a 290-ft. earth and rock-fill dam on the Upper Holston River in northeastern Tennessee, was resumed after a war-time shutdown. Spillway and power tunnels at Watauga are nearing completion. Raising of Hales Bar Dam 3 ft. to provide full navigation depths to Chickamauga Dam, 40 mi. upstream, was begun in July; piers are being built into the spillway to accommodate tainter gates for stream-flow regulation.

TVA's electrical load, which dropped 25 percent at the end of the war, is now above war-time demand. Design and construction is under way on the installation of 154,000 kw. of additional system capacity in existing hydro plants and the work is now entering the active construction stage. This added capacity consists of one generating unit at Douglas, two units at Wheeler, and two units at Fort Loudoun.

TRANSPORTATION PROJECTS

WILBUR CROSS PARKWAY—Work was continued during 1946 on Wilbur Cross Parkway in Connecticut, which is an extension of the Merritt Parkway past New Haven toward Hartford. Six miles of four-lane divided highway costing $1,650,000 were opened to traffic during the year. This section provides a by-pass for Meridan. Between Meridan and Hamden, nine miles of grading costing $1,270,000 was completed and contracts were let for nine structures. In 1947 it is estimated that $1,400,000 will be spent on paving the graded sections. Grading and structures will be started on the section between Hamden and Orange at a cost of $2,900,000. Within the next two years the balance of work on the parkway should be completed at an additional cost of $2,400,000.



High fills and deep cuts mark construction of Northern Pacific 16½-mile $3,000,000 line change across rolling prairies of North Dakota, which will reduce distance, grades and curvature. At this stream crossing, concrete pedestals on pile foundations will carry steel tower supporting three simple girder spans.

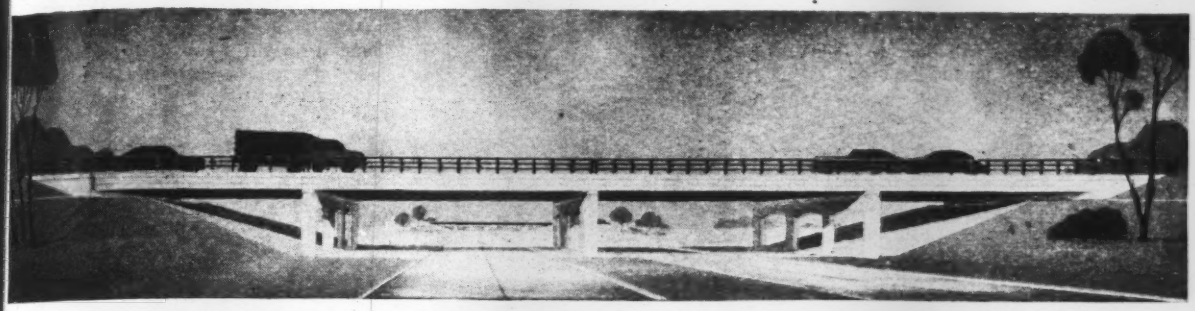
PENN-LINCOLN PARKWAY—Work is under way on two sections, about 2 mi. of the Penn-Lincoln Parkway. The road is designed to give greatly improved access to Pittsburgh from the east from Route 22, the William Penn Highway, and U. S. Route 30, the Lincoln Highway. Major bridges and a 2,500 ft. tunnel are part of the project.

BROOKLYN-BATTERY TUNNEL—Following resumption of work in 1945, after a wartime halt New York City's two-tube vehicular tunnel from lower Manhattan to Brooklyn has made good progress under supervision of the Triborough Bridge and Tunnel Authority. Tunneling in rock from the Manhattan end, a 24x24 ft. bottom drift was driven to the location of the ventilation shaft at Governors Island and now enlargement to 31-ft. external diameter is nearing completion. Shields driven from the Brooklyn end have advanced 2,700 and 2,550 ft. in the two tubes and now are entering the solid rock section near Governors Island. Both tubes will be cast-iron and concrete-lined for their full length and each will accommodate two lanes of traffic. Work is underway on the ventilation shaft at Governors Island, as well as the Brooklyn and Manhattan approaches. Contracts have been let for ventilating equipment and the Brooklyn ventilating building. The tunnel, estimated in 1939 to cost $80,000,000 is expected to be complete in 1949.

DETROIT EXPRESS HIGHWAYS—Construction started on the John C. Lodge Expressway, includes two contracts in connection with a million-dollar railroad grade separation, and a sewer reconstruction project. Some $1,750,000 worth of right-of-way has been purchased and an additional $4,000,000 is to be acquired. Seven contracts, totaling $2,195,000 are planned for letting this year. They include two grade separations relocation of city-owned utilities, a bridge carrying Milwaukee Ave. over the expressway, and initiation of construction in the Union Depot area.

COOK COUNTY HIGHWAYS—On the Calumet-Tri-State superhighway system south of the Chicago city line, two grade separations and two bridges are under construction. Plans for four grade separations and one river bridge, estimated to cost $1,800,000, have been submitted for state approval. Four grade separations are ready for contract and bids on $1,500,000 of storm sewers will be received soon. Three sections of main thoroughfares for the Calumet and one section for the Tri-State superhighways will be ready for contract this summer. These parts of the two superhighways will be constructed as a portion of the Chicago-Detroit Expressway.

DALLAS CENTRAL BOULEVARD-EXPRESSWAY—Construction of the Hall Street overpass, first unit of an 8.8 mi. expressway through the center of Dallas.



Under construction by Cook County Highway Department is this grade separation structure carrying 167th St. across Calumet superhighway. The Calumet-Tri-State superhighway sections eventually will form part of Chicago-Detroit's expressway; ultimate construction contemplates three 12-ft. lanes in each direction, separated by landscaped median strip.

Texas, was started in January. Contracts for 2.8 mi. of the project costing about $3,600,000 are expected to be let soon. By the end of 1947 contracts may be let on 5 mi. of work costing $5,900,000.

MAINE TURNPIKE—Contracts for all grading, bridges and paving on the first section of the Maine Turnpike have been let. This section extends from the Maine-New Hampshire border at Kittery to Portland, a distance of 44 mi., and is the only section of a projected toll highway across the state to be built at present. Grading was far enough advanced when work was shut down for the winter to permit an early start on paving in the spring. The highway is to be opened late in 1947. It is to be a four-lane divided highway paved with bituminous concrete.

NEW YORK STATE THRUWAYS—Work was begun at three points on the 486-mi. system of thruways to be built from the New York metropolitan district up the Hudson River valley and west across the state to the Pennsylvania line. Each thruway is to be a controlled-access highway with four or six lanes divided by a wide median zone. The six contracts let are for grading in the central part of the state. Paving contracts on the graded sections are to be let this year.

NEW JERSEY ROUTE 100—Grading contracts on the first section of Route 100 in New Jersey have been let and more work will be put under way this year. This controlled-access highway, which is roughly parallel to U. S. Route 1 in northeastern New Jersey, will have a central four-lane divided high-speed highway which will be separated by median zones from two outer two-lane highways, a total of eight lanes. Work under the first program, covering 16.1 mi., will cost $44,000,000.

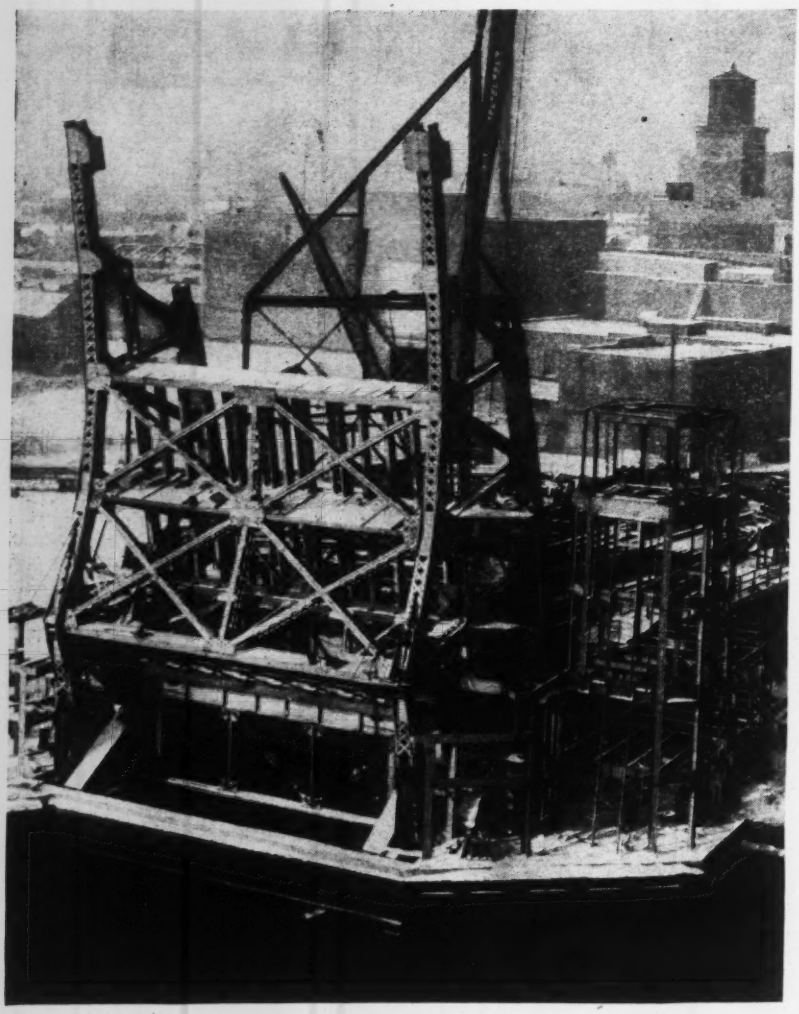
HOUSTON EXPRESSWAYS—Three contracts totaling $4,214,000, have been awarded by the Texas State Highway Department for expressways through Houston, Texas. The largest, amounting to $2,050,000 covers construction of 1.2 mi. of complete expressway, including two combination railroad and street overpasses with interchange roadways, six 12-ft. traffic lanes in the freeway section, with 4-ft. median barrier, 32-ft. frontage roads, sidewalks and complete sodding of the entire earth area within the right-of-way which has a minimum width of 210 ft. The second contract includes 2.4 mi. of trunk-line sewer and 2.5 mi. of laterals costing $1,204,000. The third project, to cost $957,000, covers improvement by widening and new construction of four 1.1-mi. parallel streets, construction of storm sewers, and installation of a $281,300 traffic signal system reported to be the largest single installation of its kind. Plans have been completed for 9-mi. of expressway construction costing $16,000,000. Bids of $1 to 2 million are to be taken monthly on sections of this work until the nine miles are contracted.

CALIFORNIA FREEWAYS—Construction of freeways to relieve traffic congestion caused by more than 2,000,000 new inhabitants in California since 1940 is being expedited. Housing on rights-of-way is holding up parts of the program. Work under way in the San Francisco area on Bayshore Freeway contracts amounts to $4,500,000 and bridge contracts totaling $2,259,000 have been let for the East Shore Freeway through Oakland. In the south contracts have been let for the following amounts: Santa Ana Freeway, $3,600,000; Cabrillo Freeway, $3,800,000; and Terminal Island Access Freeway, $5,200,000. Rights-of-way have been purchased and, in part, have been cleared of buildings preliminary to letting major contracts this year on the Harbor and Hollywood freeways, which will minimize Los Angeles congestion.

Mechanically-tamped ballast on the Rock Island's relocated Kansas City-Chicago line through Iowa includes 4 in. of chat or 5 in. of slag on 8 in. of mineral refuse, which is obtained from zinc smelters.

LAKELAND FREEWAY, CLEVELAND—Work was started during 1946 at several points in Cleveland on the freeway that ultimately is to extend from E. 9th Street a distance of about 30 miles to Painsville. This two 50-ft. wide pavements were laid from E. 9th St. along the lake front to E. 26th St. From E. 26th St. to E. 72nd St. the city is filling in the lake front to provide additional right-of-way. From E. 72nd St. plans are being made to carry the freeway through Gordon Park to E. 88th St. From that point to Eddy Road (1.63 miles) grading is under way and a contract has been let for paving of two lanes of the four-lane road. Plans for the Eddy Road interchange will be ready for contract late in 1947. From the Eddy Road interchange to E. 140th St. and Lake Shore Blvd. a contract has been let for grading the 144-ft. right-of-way and for paving two of the four lanes.

EAST BOSTON AIRPORT—The Massachusetts Department of Public Works is expanding the East Boston Airport in accord with a master plan that will provide by 1948 adequate landing facilities for at least a decade at a total cost of about $45,000,000. Hydraulic dredging and hauling from islands in East Boston Harbor was used in building up 2,000 acres of previously partially submerged land. Three temporary runways are in operation and a temporary terminal building has been completed. Permanent paving consists of 6-in. sand-bound stone sub-base; 4.5 in. of penetrated stone base course, and 2.25 in. of bituminous concrete. Paving is now completed on two 300-ft. wide 7,000-ft. long runways and work is under way on



North leaf of Chicago's Canal St. Bridge is 40 percent erected, and city hopes to make use of the double-leaf trunnion bascule structure this year. Because strike delayed delivery of trunnion bearings, contractor erected all movable steel of north leaf in temporary position without support from bearings. After bearings are received, huge mass of steel will be adjusted vertically and horizontally to line and grade for final position on trunnions.

additional runways and taxiway facilities. Shoulders are paved for a width of 100 ft. wide along the permanent runways. The permanent terminal building is expected to cost $9,000,000—it will be in partial use next fall.

GREATER PITTSBURGH AIRPORT—Work is half completed on a 3,500,000 cu. yd. $2,499,000 contract for grading at Pittsburgh's airport, 15 mi. west of the Golden Triangle. Expenditures, by Allegheny County, of $5 to $8 million are anticipated for 1947 for runways, taxiways, terminal buildings and a high-speed parkway to the airport. Bids will be asked about March 1 for terminal building foundations. Three 5,500 ft. long, 150 ft. wide runways built by the army are now in use and five more are planned to make a duplicate four-runway pattern.

NEW YORK CITY AIRPORTS—More political and financing news than construction progress has been made on New York City's airports during the past year. Uncertainty concerning financing and administration have permitted only minor construction at the 5,000-acre Idlewild Airport where more than $200,000,000 may eventually be spent. Three runways and a temporary administration building were completed a year ago. Some shoulder paving along the first runways, as well as extension of drainage lines and grading for the second set of three runways has been done this year. Union jurisdictional disputes have prevented connecting communication lines so no commercial landings have been made and it is not certain that the port will be used in 1947. New York City is expected to decide soon whether the bi-state (N.Y.-N.J.) Port of New York Authority, the newly created New York City Airport Authority or the city itself will complete and operate Idlewild and rehabilitate sinking La Guardia Field. Work at La Guardia is largely stabilizing the field by expediting settlement of the underlying silt, which is consolidating at a rate of 4 in. per year, and can be expected to reach natural stability at a settlement of 12 ft. over a fifty-year period. Estimated cost of rehabilitation is $12,000,000 with consolidation to be accomplished in one year's time by installing vertical sand drains—but the airport may be out of service for a year or more.

CHICAGO AIRPORTS—Three city airports in Chicago are in process of construction, betterment or design study. At the Municipal Airport, twin hangars of reinforced-concrete design are being built for American Airlines at a cost of about $2,500,000. United Air Lines has started one hangar and is remodeling and enlarging existing hangars. The city's new passenger terminal building, about 1,400 ft. long, will be finished in 1947.

Of the other two airports, one entering the construction stage is a downtown facility for small planes consisting of a single flight strip 2,800 ft. long on Northerly Island along the lake-front close to the Loop. More than $1,000,000 is to be available for construction involving one-half mile of steel sheetpile bulkhead and 500,000 cu. yd. of sand fill.

Plans are progressing for the Chicago Orchard airport (also called the Douglas airport), the large $72,000,000 facility to be constructed northwest of the city. At present, the city has assurance of only a little more than $21,000,000 in municipal and federal funds for the project.

WASHINGTON NATIONAL AIRPORT—A contract for the construction of five new hangars at the National Airport has been awarded. Costing about $4,500,000, the work will be completed this year.

ST. LOUIS AIRPORT—Grading and drainage contracts amounting to $2,500,000 for airport improvement are scheduled to be 75 percent completed during 1947.

SAN FRANCISCO AIRPORT—Some 5,000,000 cu. yd. out of a 6,000,000 total has been placed in the fill at San Francisco's municipal airport and completion of the present fill contract is scheduled for about the end of February. Specifications are to be ready for bidders on the next step, an additional 5,000,000-cu. yd. fill, which is to be completed by November. Simultaneously, a large amount of paving and drainage work is scheduled. These improvements are being done under the city's $20,000,000 airport bond issue.

B. & O. RELOCATION—In preparation for Dillon Dam and reservoir, a Corps of Engineers flood-control project, on the Licking River above Zanesville, Ohio, the Baltimore & Ohio R. R. is being raised and relocated for 21 mi. Construction requires more than 4,000,000 cu.yd. of excavation of which about two-thirds is rock. Cuts range up to 115 ft. deep and of a half a million yards of material. Earth excavation has been largely completed.

rock work is continuing through the winter and completion is expected this year.

PENNSYLVANIA RELOCATION—Some 16 mi. of double-track freight line of the Conemaugh Division of the Pennsylvania Railroad near Blairsville, Pa. is being moved to above expected waters of the Conemaugh flood control reservoir planned for construction by the Corps of Engineers. Some 3,000,000 cu.yd. of earth and rock excavation, seven major bridges, and a total of 60,000 cu.yd. of concrete make up the principal quantities of relocation contracts that amount to about $6,500,000 and are about half completed.

ROCK ISLAND RELOCATION—Two relocation projects in Iowa were completed by the Chicago, Rock Island and Pacific Ry. totalling 34.5 mi. of new single-track line. A third project, involving 17.2 mi. of new line between Ainsworth and Brighton, Iowa, started last May and scheduled for completion this spring, will complete the Rock Island's five-year relocation program in Iowa and Missouri. The 72.5 mi. of new grade and single track constructed under this program will reduce mileage between Kansas City and Chicago by 12.3 and the running time by 1¾ hr. Built to a maximum curvature of one degree and to an operating grade of 0.5 percent, the new alignment will permit increasing single-engine freight train loads from 2,300 to 5,000 tons.

NORTHERN PACIFIC RELOCATION—Grading has been completed and construction of five bridges is well along for a 16.5 mi. line change west of New Salem, N. D., on the Mandan-Dickinson division of the Northern Pacific Ry. The new location reduces track length by 9.3 mi., cuts the ruling grade for this portion of the main line from 1 percent to 0.45 percent for the railroad's heavier eastbound tonnage and to 0.60 percent for westbound traffic, and decreases total curvature from a previous 670 deg. to 109 deg. Total cost of the change will be about $3,000,000. Contracts for ballast and tracklaying will be awarded soon.

TOLEDO LAKEFRONT TERMINAL—To improve facilities for rail-water trans-shipment of coal, ore and other bulk freight at Toledo, the Lakefront Dock and Railroad Terminal Co. is constructing an $18,500,000 project comprising three piers of steel sheetpile bulkhead and earth-fill design, equipped with three car dumpers and two ore unloaders, plus terminal and supporting yards with a total track length of about 55 mi. Two existing car dumpers, to be transferred from their present location in Toledo, should be in operation at the new site in 1948.

RIVERS AND HARBORS WORK—Seven major rivers and harbors projects are underway and for these and other jobs additional large contracts may be awarded in 1947. One project calls for continued improvement of the New York Harbor by dredging Ambrose and Anchorage channels. Improvement of this harbor by dredging and rock excavation in the Arthur Kill channel also is in progress. Regulating works on the Mississippi between the Ohio and Missouri rivers and the $25,000,000 lateral canal project at the Chain of Rocks above St. Louis are being built. On the Upper Mississippi at Hastings, Minn., a $3,500,000 project is underway to complete the second lock at Dam No. 2. A $4,000,000 project on the Missouri River to provide a 6-ft. channel between Sioux City and the mouth by construction of dikes and other regulating works is advancing. At Long Beach, Calif., work is in progress on the $7,100,000 project calling for completion of the 13,500-ft. detached breakwater.

During 1946 work was completed on columns for the approaches to the Terminal Island, Calif., Lift Bridge being built up by the Navy at a cost of some $5,000,000. On the left can be seen some of the first steel girders to be installed on the southern approach.

GULF INTRACOASTAL WATERWAY—Construction of the Gulf Intracoastal Waterway extending from Sabine River to Brownsville, Tex., was 57 percent complete on Jan. 1, 1947. No new construction has been contracted since last July, due to the Presidential limitations on such new construction. Sections of the waterway completed last year include a 17-mi. length extending northward from Port Isabel, Tex., which involved 7,526,000 cu.yd. of excavation. Another project, containing 7,150,000 cu.yd. of excavation in 12 mi. of new channel extending southward from Corpus Christi Bay, has been completed.

Principal contracts awarded for work on the waterway in the New Orleans District during 1946 include foundation and concrete work, scheduled for completion in February 1948 and estimated to cost $1,700,000; for the Bayou Sorrel lock through the East Atchafalaya guide levee; and for the Plaquemine-Morgan City alternate waterway route. Another project, scheduled for early completion, involves 2,500,000 cu.yd. of excavation for a drainage and temporary navigation canal near Lake Palourde, La.

CHICAGO SUBWAYS—A contract is being executed for construction of the final $8,250,000 section required to complete the Milwaukee Ave.-Dearborn St.-Congress St. subway in Chicago. It calls for 2,271 ft. of double tube and 1,084 ft. of single tube. The double-tube subway, completed southward to Dearborn and Van Buren streets before work was stopped in 1942, will turn from this point into the line of Congress St. and continue westward almost to the Chicago River. The western portion will be a single-tube turn-around loop.

BRIDGES

INTERNATIONAL RAILWAY BRIDGE—Plans have been completed for the construction of a 368-ft. span vertical lift bridge at the Soo to replace an old swing span of the International Railway Bridge, built in 1888. Total cost of the project, including removal of the swing span and Bridge Island, which separates the approach channels to the MacArthur and Poe locks, is estimated to exceed $1,000,000. When completed the new span will have a maximum clearance of 155 ft. above low water datum.

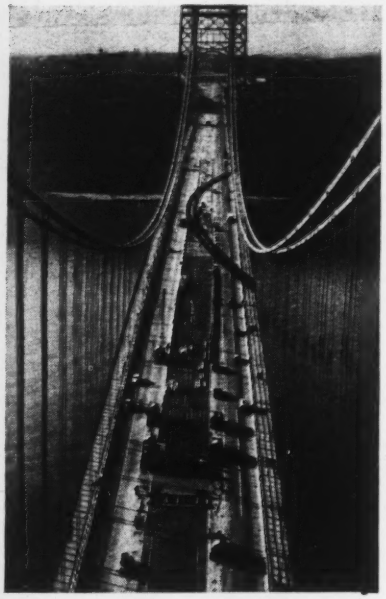
EADS BRIDGE—By April of this year the upper deck of the 74-yr. old 1,588-ft. Eads Bridge over the Mississippi River at St. Louis will have a complete new roadway for highway traffic, 40 ft. 4 in. wide,

with two 4-ft. 7½-in sidewalks. The new floor system, consists of 4½-in. concrete-filled steel grating on 21-in. rolled steel floorbeams. It weighs 800 lb. per foot of bridge less than the old timber and steel-framed deck which it replaces.

CHICAGO, ILL.—Construction has been resumed on two Chicago River bridges stopped by the war in 1942 after the substructures were complete. At the North State St. bridge, the superstructure contractor resumed active work last summer. The double-leaf trunnion bascule structure 108 ft. wide, with a clear span of 210 ft., may be opened to traffic in 1948. On a similar $1,800,000 bridge of smaller size for the South Canal St. crossing of the South Branch of the Chicago River, progress is advanced farther. With 40 percent of the steel in the north leaf already erected, the city hopes to put traffic over the bridge before the year ends.

KAW RIVER—Reconstruction of the Twelfth Street Bridge in Kansas City, Kan., partially destroyed when 1945 floodwaters of the Kaw River undermined and overturned one of its piers, may be completed this fall. Estimated to cost $330,000, the project (complete with 22-ft. roadway for highway traffic, and one sidewalk) includes rebuilding of one 200-ft. span and seven panels (140 ft.) of the center span of a three-span, 600-ft. long deck cantilevel containing 80-ft. suspended spans. In addition to replacing the overturned pier, a second river pier will be removed and rebuilt on piling to safeguard against future scour.

CHAIN-OF-ROCKS—Construction of the Chain-of-Rocks Canal Bridge near St. Louis, on which a $1,585,000 contract was let in August, 1946, is about 2 percent complete. The bridge will carry U. S. Highway 66 over the proposed Chain-of-Rocks canal on a relocation of the present road.



George Washington Bridge traffic capacity was increased by paving an open 32-ft. section in the center of the bridge. The roadway now accommodates eight lanes of traffic, providing for an estimated capacity of 20,000,000 vehicles per year.

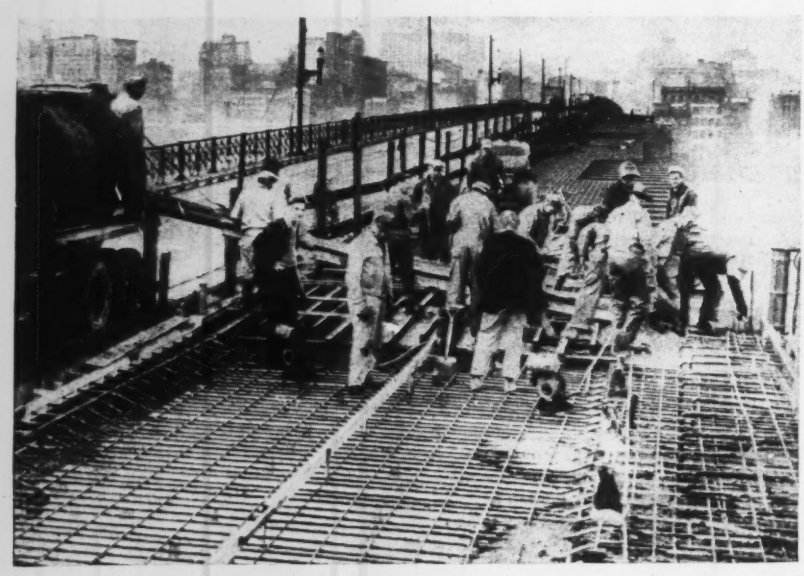
TACOMA NARROWS—Rebuilding of the Tacoma Narrows Bridge for which plans have long been ready and which was to have been under way before now, was held up by the desire of the insurance syndicate, made up of 75 member companies, to get expert opinion on the ability of the piers to support a bridge heavier than the one for which they were designed. Modjeski & Masters, Pittsburgh, Pa., were retained for this purpose. Late in January it was announced that the piers had been found adequate. When insurance has been secured it is planned to issue simultaneously a call for bids on construction and for financing the work—probably in March. New financing is necessary because the $4,000,000 collected when the former bridge collapsed went to pay off the bondholders. The new superstructure is expected to cost $8,000,000.

TERMINAL ISLAND, CALIF.—Piers for a $5,000,000 bridge connecting Terminal Island and Long Beach were practically completed in 1946, and superstructure erection is now under way. A Navy project scheduled for completion late in 1947, the new bridge will include a 240-ft. vertical lift with 50-ft. clearance in the down position. Construction of a freeway providing access to the bridge is under the supervision of the state highway department, with financing for both the bridge and the freeway provided to the extent of $14,000,000.

SAN FRANCISCO, CALIF.—Decisions are expected in 1947 regarding the nature and location of a new San Francisco-Oakland bay crossing to supplement the existing bridge on which the demand is so heavy that rush-hour crossings are greatly delayed. The state bridge department is proceeding with studies on sites for a new bridge, and the report of a joint Army-Navy board which considered all types of crossings including fill causeways is to be submitted soon to Congress.

WASHINGTON, D. C.—All of the nine main piers for the South Capitol St. crossing of the Anacostia River in Washington have been founded and work is nearing completion on the $2,500,000 substructure contract. The bridge is to be of plate-girder construction with the main crossing 854 ft. long, including a 386-ft. swing span at the main channel. The north approach will total 1,400 ft., and on the south bank about 1,300 ft. of ramp will be required. Because the lowest bid for the superstructure was nearly double the engineer's estimate of $1,000,000 all bids opened Oct. 31 were rejected, but will be retaken soon.

MEMPHIS BRIDGE—All of the main piers for the Mississippi River bridge have been founded, the last one—on the Tennessee bank—being sealed in January. Five of the seven piers are complete while the remaining pier in the main channel is above high water; construction on the last is scheduled to keep above floods. Three piers on the Arkansas side were sunk by open dredging and sealed without unwatering. The other four, on the sloping banks and in the main channel, were sunk by open dredging but cleaned and sealed in the dry, using up to 43 psi. of air. A contract has been let for additional approach work on the Arkansas side.



Eads Bridge at St. Louis gets a new steel and concrete roadway on its upper deck, weighing less than the old timber and steel-framed deck. The bridge has seen service for three-quarters of a century.

Bridge, Monroe County, Indiana

(*Continued from preceding page*)

LIST OF BIDDERS:

1. G. H. Allen, Vincennes, Ind. (contract) $57,143.47
2. Robert H. King, Danville, Ind. 57,737.75
3. Rieth-Riley Const. Co., Goshen, Ind. 60,192.05

Item	Quantity	Unit Prices: Engineer's Estimate	(1)	(2)
1 Class D concrete	175.2 cy	$50.00	$46.00	$50.00
2 Class E concrete above footings	115 cy	50.00	46.00	45.00
3 Class E concrete in footings	80.2 cy	45.00	46.00	45.00
4 Handrail	174 lf	7.00	6.00	6.00
5 Reinforcing steel	50,645 lb	.09	.085	.08
10 Cast iron	533 lb	.30	.25	.30
11 Wet excavation	147 cy	10.00	6.00	10.00
12 Waterway excavation	5,825 cy	.75	.60	.65
13 Common excavation	5,700 cy	.60	.60	.65
14 Special borrow	2,990 cy	.70	.60	.70
15 Special filling material	1,335 cy	2.00	2.50	2.50
16 Sodding	2,665 sy	.50	.40	.40
20 Thickened reinforced concr. pavement	131 sy.	5.00	5.00	4.00
21 Removal present structure	lump sum	1,250.00	500.00	500.00
23 Mulched seeding	14,000 sy	.15	.10	.10
24 Class X excavation	52 cy	15.00	15.00	10.00
25 Class Y excavation	25 cy	5.00	15.00	2.00
26 Paved side ditch type A	121 lf	2.00	1.50	.200
27 Paved side ditch type F	38 lf	4.50	4.00	4.50
28 Compacted aggregate surface—9"	6,680 sy	2.25	1.90	1.75
29 Corrugated metal pipe—12"	20 lf	2.25	2.00	2.00
30 Corrugated metal pipe—15"	20 lf	2.65	2.50	2.50
31 Corrugated metal pipe—18"	28 lf	3.00	2.75	3.00
32 Corrugated metal pipe—24"	20 lf	4.25	4.00	4.00
33 Pipe—12"	70 lf	2.35	2.00	2.00
34 Pipe—15"	72 lf	2.75	2.50	2.50
35 V.c., r. c., c. i., or c. m. pipe—36"	132 lf	8.00	7.50	8.00
37 Pref. bitum. expansion joint—1"	51 lf	.80	.50	1.00
38 Finishing shoulders and ditches	2,600 lf	.35	.20	.40
39 Flexible steel plate guard rail	272 lf	3.00	2.25	2.00
40 Aggregate for shoulder drains	25 ton	5.00	4.00	4.00
41 Compacted aggregate surface—6"	319 sy	1.75	1.50	1.50
42 Standard signs (4' x 4')	12 ea	40.00	35.00	30.00
43 Standard barricades	3 ea	75.00	60.00	60.00

Earth Road, Salt Lake Co., Utah

OWNER: State Road Commission, Salt Lake City, Utah; Roy W. McLeese, State Road Engineer.

PROJECT: Graded and drained earth road in Salt Lake County, extending from Mountain Dell to Big Mountain Summit. Roadway to be 26 ft. wide and 5.028 miles long.

CONDITIONS: Typical rolling mountain terrain will be encountered. Access to job site will be by highway only. Contract was awarded October 22, 1946 and is to be completed by June 30, 1947. Skilled wage rates range from $1.25 to $1.875 per hour; semi-skilled wages are $1.125 per hour, and common labor wages, $1.00 per hour.

BIDS: Three bids were received October 22, 1946; ranging from the contract low of $208,113.95 to $289,257.40. The low bid is 3.6 percent above the engineer's estimate of $200,963.95.

LIST OF BIDDERS:

1. W. W. Clyde & Co., Springville, Utah (contract) $208,113.95
2. Floyd S. Whiting, Salt Lake City, Utah 234,812.50
3. Palfreyman Const. Co., Provo, Utah 289,257.40

Item	Quantity	Unit Prices: Engineer's Estimate	(1)	(2)
1 Unclassified excavation	318,000 cy	.40	0.405	.56
2 Overhead, class A	440,000 st y	.02	.015	.015
3 Overhaul, class B	2,000 mi y	.20	.25	.25
4 Watering	2,700,000 gal	1.50	1.00	1.00
5 Rolling	2,400 hr	4.50	4.00	4.50
6 Surface ditches	20,000 lf	.07	.10	.05
7 Clearing and grubbing	60 ac	150.00	250.00	200.00
8 Concrete, class A	61 cy	40.00	45.00	40.00
9 Reinforcing steel	11,700 lb	.09	.10	.10
10 Excavation for structures	600 cy	1.50	1.50	2.00
11 Concrete pipe—18"	2,041 lf	3.00	3.50	3.50
12 Concrete pipe—24"	1,626 lf	4.00	4.50	4.00
13 Concrete pipe—36"	135 lf	7.50	8.40	8.00
14 Concrete pipe—60"	111 lf	17.00	20.00	20.00
15 Right of way fence, type B	5,000 lf	.20	.25	.25
16 Gates—14'	5 ea	25.00	25.00	25.00

Bridge and Substructures, Kern Co., California

OWNER: Division of Highways, Sacramento, California; G. T. McCoy, State Highway Engineer.

PROJECT: Construction of one concrete bridge and substructures for four additional bridges, and grading and bituminous surfacing of 10.2 miles. Site is between Keene and Telechapi in Kern County.

CONDITIONS: The State will furnish all material for inside steel guard rails and railroad rails. Access to job site is available by both railroad and highway. Contract time is 350 working days. Minimum wage rates are: common labor, $1.15 per hour; semi-skilled labor, $1.15; and skilled labor, $1.375.

BIDS: Nine bids were received December 1, 1946, ranging from the contract low of $1,096,600.00 to $1,573,128.95.

LIST OF BIDDERS:

1. Guy F. Atkinson Co., South San Francisco, Calif. (contract) $1,096,600.00
2. M. M. Ball Sons, Berkeley, Calif. 1,173,519.30
3. Winston Bros. Co., Los Angeles, Calif. 1,212,284.80
4. Bressi & Bevanda Constructors, Inc., Los Angeles Calif. 1,239,881.30
5. Morrison-Knudsen, Inc., Los Angeles, Calif. 1,295,889.90
6. A. Teichert & Sons, Inc., Sacramento, Calif. 1,299,277.80
7. Clyde W. Wood, Inc., North Hollywood, Calif. 1,368,678.00
8. Vinnell Co., Alhambra, Calif. 1,530,121.80
9. Haddock Engineers, Ltd., Oceanside, Calif. 1,573,128.95

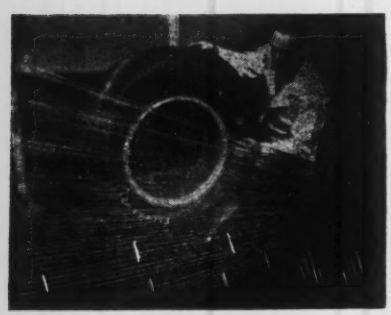
Item	Quantity	Unit Prices: (1)	(2)	(3)
1 Clearing and grubbing	lump sum	$14,000.00	$15,000.00	$4,000.00
2 Roadway excavation	555,000 cy	.57	.78	.71
3 Structure excavation	15,500 cy	2.25	1.90	3.00
4 Bridge structure excavation	2,575 cy	5.00	11.00	4.30
5 Ditch and channel excavation	4,230 cy	1.50	2.00	2.10
6 Trench excavation	8,500 cy	1.25	1.50	1.20
7 Overhaul	5,090,000 st y	.005	.008	.006
8 Compacting original ground	28,500 sy	.05	.03	.04
9 Imported borrow	62,000 cy	.90	.95	.90
10 Developing water supply and furnishing water equipment	lump sum	5,000.00	3,000.00	3,000.00
11 Applying water	4,310,000 gal	2.50	1.90	3.25
12 Finishing roadway	541 st	15.00	10.00	15.00
13 Preparing mixture and shaping surface (bit. surf. tr.)	194,060 sy	.10	.065	.12
14 Liquid asphalt SC-4 (bit. surf. tr.)	2,020 ton	16.00	16.00	16.00
15 Cl. "A" portland cement concrete (structure)	1,495 cy	55.00	50.00	55.00
16 Cl. "A" portland cement concrete (footing blocks)	152 cy	30.00	30.00	40.00
17 Cl. "A" Portland cement concrete (trash racks)	10 cy	95.00	63.00	80.00
18 Cl. "C" Portland cement concrete	335 cy	40.00	30.00	40.00
19 Portland cement concrete walls	4,000 cy	31.00	26.00	32.00
20 Furnishing bar reinforcing steel	186,700 lb	.065	.08	.06
21 Placing bar reinforcing steel	186,700 lb	.045	.02	.04
22 Placing railroad rails	95,000 lb	.05	.04	.04
23 Timber bridge railing	24 lf	6.00	4.00	4.00
24 Miscellaneous steel	3,980 lb	.50	.50	.40
25 Furnishing steel piling	2,050 lf	3.25	4.00	3.00
26 Driving steel piles	64 ea	75.00	125.00	75.00
27 Steel pile splices	7 ea	25.00	23.00	25.00
28 Inside steel guard rail	lump sum	2,000.00	2,500.00	900.00
29 Pneumatically applied mortar	6,000 sf	.50	.25	.40
30 Cast steel frames and covers	1 ea	100.00	80.00	150.00
31 Rubble masonry	2,412 cy	31.50	27.00	40.00
32 Rubble masonry slope paving	2,800 cy	32.00	20.00	28.00
33 Portland cement concrete curbs	30 cy	50.00	40.00	40.00
34 Monuments	205 ea	5.50	7.50	8.00
35 Metal plate guard railing	660 lf	4.50	3.00	2.50
36 Culvert markers	100 ea	4.50	5.00	4.50
37 Guide posts	275 ea	5.50	5.00	5.00
38 New property fence, type A	15.5 mi	1,150.00	2,700.00	2,200.00
39 New property fence, type B	3.0 mi	1,150.00	2,700.00	2,200.00
40 Removing and reconstructing existing property fence	0.5 mi	1,150.00	1,200.00	1,900.00
41 Drive gates	35 ea	50.00	75.00	100.00
42 8" corrugated metal pipe down drains (16 gauge)	3,450 lf	1.50	2.10	1.50
43 24" corrugated metal pipe (14 guage)	1,426 lf	4.25	4.20	3.80
44 30" corrugated metal pipe (14 guage)	292 lf	5.75	5.30	5.00
45 36" corrugated metal pipe (10 guage)	150 lf	9.50	8.60	9.00
46 36" corrugated metal pipe (8 guage)	216 lf	12.00	10.50	10.00
47 48" corrugated metal pipe (8 guage)	524 lf	15.50	14.00	14.50
48 90" field assembled plate culverts (512-18)	60 lf	50.00	36.00	25.00
49 Rock filling material	5,500 cy	7.50	5.60	8.00
50 Spillway assemblies	80 ea	32.50	37.00	30.00
51 Salvaging existing pipe culverts	38 lf	2.50	1.00	2.00
52 Relaying salvaged corrugated metal pipe	38 lf	2.50	1.00	2.00
53 Engineers office	lump sum	5,000.00	3,000.00	2,500.00

New Aids to the Constructor

MANUFACTURERS' LATEST DEVELOPMENTS IN EQUIPMENT AND MATERIALS

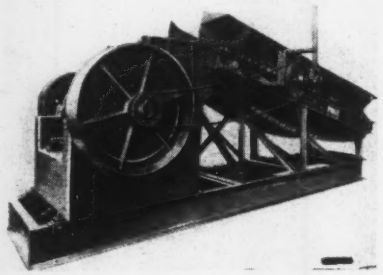
CRAWLER TRACTOR—The HD-5 is a 37 hp. tractor, designed to fill many construction needs. It has several outstanding features: Grease-packed truck wheels, idlers, and support rollers are serviced at the factory and thereafter require greasing attention only once every thousand hours. A General Motors 2-cycle diesel engine powers it and has unit injection, 4-way cooling and parts that are interchangeable with other Allis-Chalmers "71" series tractors. A comfortable soft cushion seat has arm rests that serve as auxiliary seats; a narrow engine cowl affords the operator a good view of the drawbar work. Accessible controls and convenient gear shifting arrangements give five speeds forward, ranging from 1.46 to 5.47 mph. and a reverse speed of 2 mph.

An A-frame track stabilizer design enables the HD-5 to absorb shock, eliminate twisting strains and provides rigid track alignment. A choice of two different track gauges, a 44-in. tread (10,750 lb.) and a 60-in. tread (11,250 lb.) plus 5 feet 4½ in. of track on the ground provide excellent ground contact, balance and traction.—*Allis-Chalmers Mfg. Co., Tractor Division, Milwaukee 1, Wis.*



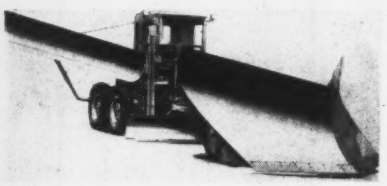
PNEUMATIC TIRES — Substituting high tensile steel wire for cotton and rayon cord, a rugged pneumatic tire, the Wire Cord tire, is considered ideal for use in the logging, mining, quarrying or construction industries. The tire runs cooler under heavy loads at high speeds; it has never been known to blow out, it gives greatly increased mileage, and because of its great body strength can be recapped several times.

The Wire Cord is built up of plies of rubberized wire cord in the same manner as the conventional cotton or rayon cord. Because of the greater strength of the wire cord, fewer plies are required than with cotton or rayon. The wire cord is .036 in. dia. It is composed of several strands of wire .0058 in. dia. twisted together. Roughly, each 9.00-20 four-ply wire cord tire contains more than 55 miles of the hair-like strands. So fine is the strand that two miles of it weighs only a pound, which means that the 9.00-20 tire contains only about 28 lb. of steel.—*Firestone Tire & Rubber Co., Akron, Ohio.*



APRON FEEDER—A new development in apron feeders is built around a unit assembly without side-boards. The feeder can be furnished either with vertical or with flared side-boards, thus making three models available. Each of these models can be furnished with any one of three drives; for gear motor, for conveyor drive, or for drive from the crusher, providing nine combinations in five lengths from 6 ft. to 14 ft. and in four widths from 30 in. to 48 in.

Pans are ½ in. forged steel plate, formed to overlap to impart great strength and rigidity. These pans, with the side-boards, provide a continuous path for the materials, and reduce spillage. They also provide a corrugated surface which prevents slippage under the load. Interlocking malleable castings, bolted to the pan ends, form a continuous wall along each edge of the feeder bed, and further reduce spillage. —*Pioneer Engineering Works, Minneapolis 13, Minn.*

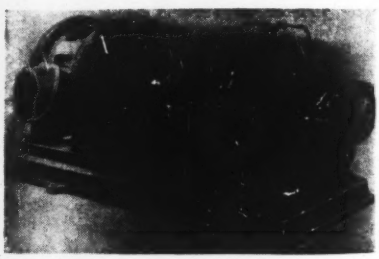


SNOW REMOVAL ATTACHMENTS—New and improved snow removal attachments are now available for the Caterpillar Diesel No. 212 motor grader as well as the two larger sizes of Caterpillar motor graders. These attachments are the V-type snow plow, mast-type snow wing and reversible one-way plow and bulldozer.

The snow wing and bulldozer are new; marked improvement in the operation of the mast-type snow wing has been effected in all sizes with modifications which insure smooth parallel lift with both ends of the blade elevated simultaneously. The mast-type snow wing for the smallest grader has a 10-ft. blade, 27 in. high with a weight of 1,500 lbs. The reversible one-way plow and bulldozer is 8 ft., 6 in. wide and 28 in. high, weighs 1,740 lbs. and has a lift of 12 inches.—*Caterpillar Tractor Co., Peoria, Ill.*

AUTOMATIC ELECTRODES — Five knurled type Una automatic wires and five flux impregnated Una tapes are designed for flat position operation. Their applications on the assembly line are many and varied, ranging from thin gauge sheet metal forms to axle housings, boilers and torque tubes.

Meeting the requirement for high speed fabrication, these wires and tapes are now available in several diameters and alloy analyses. Depending upon the application, the automatic wires may be used separately or in conjunction with the tapes.—*Wilson Welder and Metals Co., Inc., 60 East 42nd St., New York 17, N. Y.*



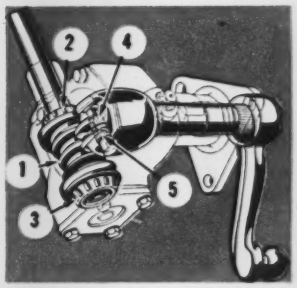
GENERAL-PURPOSE PUMP—Completing the line of general purpose pumps, the new "HSD" pump is a universally recognized single stage, horizontally split case, double suction design. Typical applications for Yeomans "HSD" pumps include: general water supply, city water booster service, hot well, condensate or make up water service; air conditioning, brine or hot water circulation; white water

REGISTRATIONS *SHOW* IT — OPERATORS *KNOW* IT!

"FORD TRUCKS LAST LONGER!"

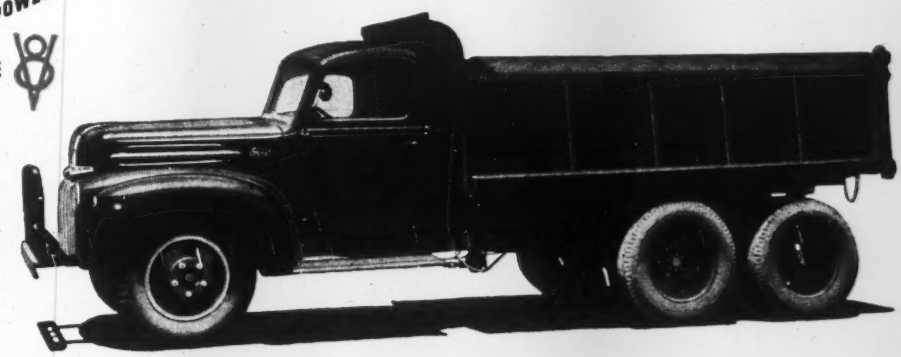
ONE big reason— FORD STEERING STANDS UP!

Ford worm-and-roller steering gear reduces *rubbing* friction to a minimum. *Rolling contact* is employed to reduce friction at five vital points. This spares muscle and saves wear. The worm gear (1) is straddle-mounted on two large, opposed, tapered roller bearings (2 and 3). The worm acts upon an easy-turning roller instead of a common sliding cam or split-nut, and this roller is mounted on two needle-type roller bearings (4 and 5). Bearings of both the worm and the sector shafts may be adjusted, thus promoting long life and proper action with less replacing of parts.



Ford

THE 6 YOUR PICK OF POWER THE V-8



A popular adaptation of the basic Ford heavy duty chassis —equipped with Fabco Dual Drive and 6-Yd. to 7-Yd. Dump body, now in service in Concord, California.

ONLY FORD GIVES YOU ALL THESE LONG-LIFE TRUCK FEATURES: Your choice of two great engines, the V-8 or the Six—semi-centrifugal clutch that needs no maintenance lubrication—rear axle design that takes all weight-load off the shafts (¾-floating in half ton units, full-floating in all others)—heavy channel section frames, *doubled* between springs in heavy duty models—big, easy-action brakes, with heavy, cast drum surfaces, non-warping and score-resistant —extra-thick sheet metal in cabs, cowls, skirts and fenders—all told, more than fifty such examples of Ford endurance-engineering.

That's why FORD TRUCKS LAST LONGER . . . why, as the national truck count for 1946 just released shows, *more than half of all Ford Trucks in use are at least 9 years old* . . . why there are more Ford Trucks in service now than ever before in history. More than 100 body-chassis combinations to choose from. Ask your Ford Dealer.

MORE FORD TRUCKS IN USE TODAY THAN ANY OTHER MAKE

"We again recall the statement that there never has been a life lost by fire in a sprinklered hotel."

— National Automatic Sprinkler and Fire Control Association.
Sept. 20, 1946

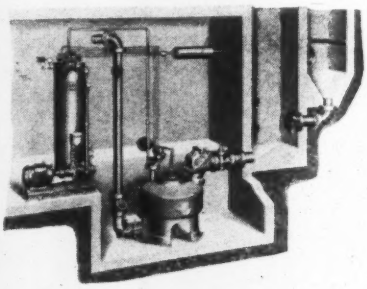
Here Is 13-Year List Of Major Hotel Fires

The following is a list of major hotel fires, and toll in lives, during the past 13 years:

Sept. 7, 1933, Houston, 54
Dec. 11, 1934, Kerns Hotel, Lansing, Mich., 32.
Feb. 12, 1936, Victoria Mansions, Lakewood, N. J., 16.
May 16, 1938, Terminal Hotel, Atlanta, 35.
March 27, 1944, Amsterdam Hotel, San Francisco, 22.
Jan. 16, 1945, General Clark Hotel, Chicago, 14.
June 5, 1946, La Salle Hotel, Chicago, 61.
June 9, 1946, Canfield Hotel, Dubuque, Ia., 19.
Dec. 7, 1946, Winecoff Hotel, Atlanta, Ga., 117.

FIRE PROTECTION
DEVELOPMENT ENGINEERING
Automatic Sprinkler
MANUFACTURE INSTALLATION
"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA
YOUNGSTOWN 1, OHIO
OFFICES IN PRINCIPAL CITIES OF NORTH and SOUTH AMERICA

or overflow service in paper mills. Capacities range to 10,000 gpm, heads to 300 ft., speeds to 3,500 rpm.—*Yeomans Brothers Co., 1433 Dayton St., Chicago 22, Ill.*



PNEUMATIC EJECTOR — A new pneumatic ejector, the type "SS" screenings ejector, is a multi-purpose unit designed to handle without clogging screenings, sludge, scum and grease—rugged duties formerly handled by two or more units in sewage treatment plants. Costs are lower than when 2 or 3 unit combinations must be used and accurate metering or pumpage can be obtained by means of mechanical or electrical counters, as the "SS" ejector is a positive displacement unit.—*Yeomans Brothers Co., 1433 Dayton St., Chicago 22, Ill.*

ROLLED NICKEL AND MONEL CLAD STRIP — Rolled nickel and Monel clad strip is available in widths between ¼ in. and 10¼-in., in coils up to several hundred feet depending upon gage. In the cold rolled condition it is produced in thicknesses between 10 and 125 one-thousandths of an inch. In the hot rolled condition it is available in thicknesses between 95 thousandths and ¼ in.

Depending on requirements, the clad strip is furnished with cladding on one side only or both sides. The standard cladding thickness is 10 percent of the total thickness. On double clad strip the three layers would be 10 percent nickel or Monel, 80 percent steel, and 10 percent nickel or Monel. It is impossible to separate the nickel or Monel cladding from the steel base by any other means than the chemical dissolving out of the steel from the cladding. —*Superior Steel Corp., Carnegie, Pa.*

LIGHTING CONTROL—The Tork "Astronomic Dial," the newest development in scientific lighting controls, will turn lights or other electrical equipment "On" at sunset and "Off" at sunrise throughout the year automatically, without any attention. It is extremely

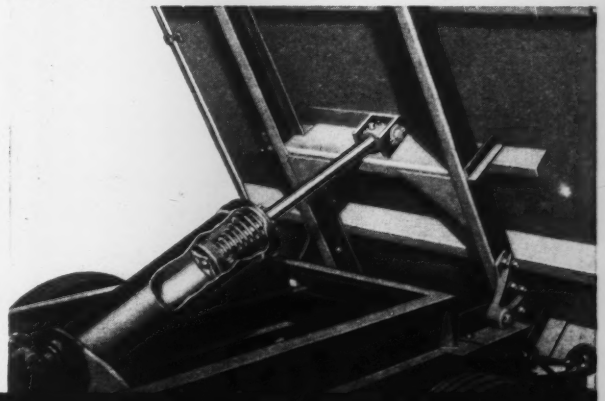
There's *plenty* of hydraulic muscle in those Gar Wood Hoists . . . plenty of *guts* to do a clean, quick dump job, no matter what you're hauling . . . plenty of *dependable* power to help you get your job done easier.

Why? They're *rugged*. All Gar Wood Hoists and Dump Bodies are designed, engineered, and built to do the toughest kinds of jobs.

What do you work with . . . sand, gravel, rock, coal, construction material? Whatever you carry, there's *at least* one type of Gar Wood Hoist and Dump Body to make the job easier, faster, safer . . . help you make more money-per-job.

Want proof? Ask the men who use Gar Wood Hoists and Dump Bodies on the toughest jobs all over the world . . . year in and year out. Ask them for an honest appraisal. See if they don't agree that *if it's Gar Wood it's got to be good!*

Then, for your *own* good . . . specify Gar Wood!



Specify Gar Wood

GAR WOOD GW INDUSTRIES

HOIST & BODY DIVISION
WAYNE, MICHIGAN

HOISTS • BODIES • WINCHES • CRANES • BOATS • HEATING EQUIPMENT • TANKS • ROAD MACHINERY

JACKSON
VIBRATORY SCREED
MODEL SC-200A

The Handiest most Efficient Hand-Screed ever Built!

The Model SC-200A is unquestionably the handiest, most efficient hand screed ever built and offers the widest possible scope in concrete surfacing operations such as floors, ramps, decks, platforms, sidewalks and similar construction. Also adaptable for placing concrete on short or odd sections of municipal pavement where mechanical finisher is impractical. Gives complete puddling to low-water content concrete, assuring the ultimate in wearing surface and economy of cement. Has self-propelling tendency in the forward direction. Second passes made by simply tilting and rolling back the necessary distance. Gets right up to walls. Stands upright by itself. Double handles for two-man operation; crossbar furnished for one-man handling of screeds not longer than 9 ft. Operates on commercial power but preferably from Jackson Power Plant which provides quick change of vibratory frequency to handle wide range of concrete mix and placing conditions, assuring thorough puddling under all circumstances. Don't buy any hand screed until you have the facts concerning the JACKSON SC-200A. See your Jackson Distributor or write, NOW!

Above: Tilted for second pass.

The self-propelling tendency makes little more than guidance necessary in the forward direction.

ELECTRIC TAMPER & EQUIPMENT CO., LUDINGTON, MICH.

accurate and may be set to operate exactly at sunset and sunrise or up to 40 minutes before and after, or "Off" at a fixed time between 11 p.m. and 1 a.m. The dial is equipped with a calendar wheel showing the month and day as well as exactly when the switch will operate.—*Tork Clock Co., Mt. Vernon, N. Y.*

TOTALIZER - INDICATOR - RECORDER — An electrically operated secondary instrument for use with Propeloflo, Shuntflo or other mechanical flow meter, or as a recording-indicating-totalizing tachometer, has been announced. The instrument is actuated by impulses over a two-wire circuit from a transmitter which is mechanically driven by the primary meter. No power supply is necessary for the primary instrument. The transmitter consists of a switch which makes a contact for a predetermined number of gallons as they pass through the meter.

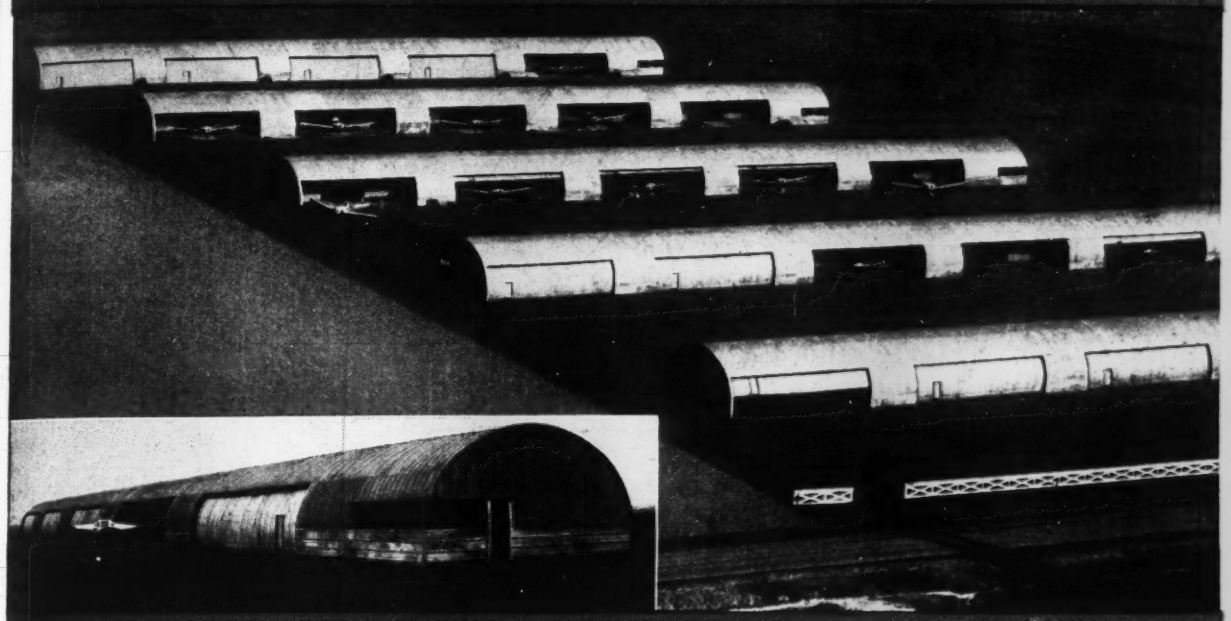
The new instrument provides readings of total flow, rate of flow and a chart record of flow over any distance from a few feet to many miles from the primary instrument; it is mounted in a rectangular case. — *Builders-Providence, Inc., Providence, R. I.*

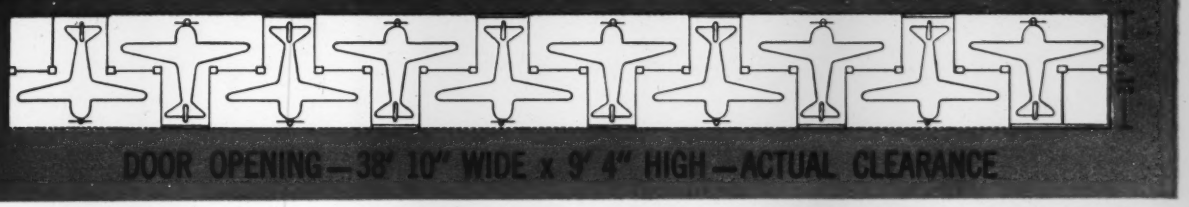
PHOTOELECTRIC COUNTER — Photoswitch photoelectric counter Type P1 provides the accurate answer to all counting problems. It consists of a photoelectric control, light source, and electric counter. The only equipment which needs to be located at the point-of-count is the control and the light source. One or more electric counters (containing the counter face and reset knob) may be placed at any convenient location and wired to the control. Remote control is thus easily obtained.—*Photoswitch, Inc., 7 Broadway, Cambridge 42, Mass.*

BUTLER BUILT

RADIAL HANGARS

Below: The progressive Pal Waukee Airport (just outside of Chicago) selected for their customers the finest in Private Plane Protection.





DOOR OPENING—38' 10" WIDE x 9' 4" HIGH—ACTUAL CLEARANCE

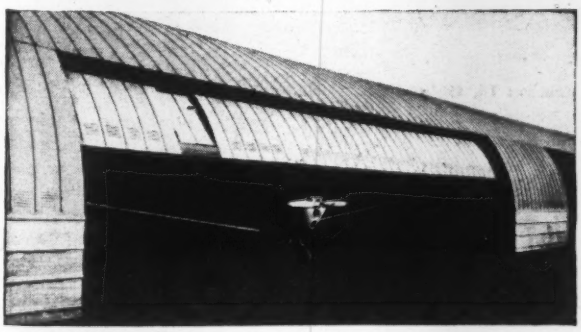
Now Available For Prompt Delivery

Airport operators and owners no longer need to wait to get small planes off the stake line or out of jam packed storage.

Fire-safe, tamper-proof Butler Radial Hangars are in volume production and available for prompt delivery in the single or multiple units. For one to ten planes, they afford each its own lock and key privacy—isolated by four walls from rough and indiscriminate handling. The front corner space at each end of single or multiple unit is well daylighted for club or office quarters or for shop and parts storage.

For sale NOW—class of the airfields—BUTLER RADIAL HANGARS. Order now for spring installation.

The Up-Over-and-Under door makes entry into the Butler Radial Hangar quick and easy. The new type may be opened by hand in seconds. It raises freely, rolls over and comes to rest under the radial roof — out of sight, out of the way.



BUTLER MANUFACTURING COMPANY
Factories: Kansas City • Galesburg • Minneapolis

For prompt handling address inquiries to:
7418 E. 13th ST., KANSAS CITY 3, MO.
918 SIXTH AVE. S. E., MINNEAPOLIS 14, MINN.

Send Full information on Butler Radial Hangars Viz.:

☐ Single Unit ☐ Multiple Unit for _____ planes.

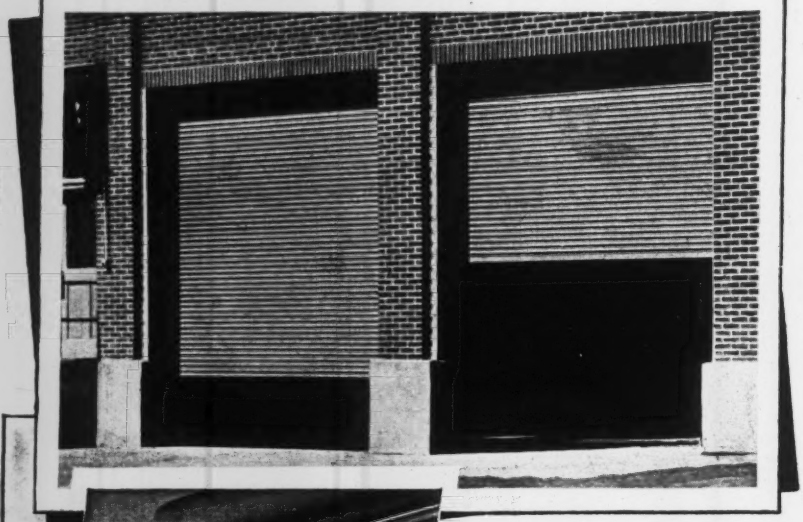
NAME _____

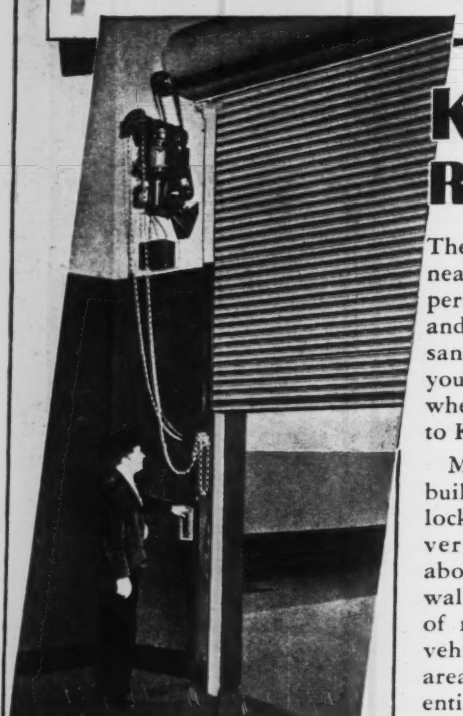
ADDRESS _____

CITY _____ STATE _____

A Ready Reference to Proved Operating Economy!

KINNEAR





KINNEAR Rolling Doors

The efficiency and economy of Kinnear Rolling Doors are *proved*—by performance records, cost records and maintenance records on thousands of installations. That's why you are sure of a sound investment when you refer your door problems to Kinnear!

Many operating advantages are built into Kinnear's famous interlocking-steel-slat curtain. By rising vertically into a compact space above the lintel, they save floor, wall and ceiling space . . . open out of reach of damage by wind or vehicles . . . require no "clearance" area for operation . . . clear the entire doorway when opened. They also assure *extra* protection against fire, intrusion, accidental damage, and the elements. Kinnear Rolling Doors are built any size, for old or new construction. *Write* for details!

Motor Operation

Kinnear Motor Operators offer extra convenience, save time, and encourage prompt door closure that cuts heating and air-conditioning costs. Push-button controls can be placed at any number of convenient points, and any number of doors may be centrally operated.

THE KINNEAR MANUFACTURING CO.
1820-40 Fields Ave., Columbus 16, Ohio
1742 Yosemite Ave., San Francisco 24, Calif.
Offices and Agents in all Principal Cities

SAVING WAYS in DOORWAYS

KINNEAR ROLLING DOORS

Men and Jobs

Lewis E. Foster, veteran of 45 years continuous government service, received congratulations on his retirement and a gift from James G. Lindley, Bureau of Reclamation supervisor of operation and maintenance in Region II. Foster went to work in 1901 for the Hydrographic Branch of the Geological Survey, forerunner of the bureau, transferring to the Reclamation Service in 1905. In 1907 he was appointed superintendent of irrigation at the Carlsbad and Hondo, N. M., projects, later becoming project manager at Carlsbad. He was made chief of the allocation and repayment division at Sacramento, Calif., in 1945.

Several changes have been made among county and city engineers in Washington state. **H. S. Donnelly** is the new Ferry County engineer at Republic while **C. Glenn Smith** is King County engineer at Seattle. Smith formerly was with the General Engineering Co. at Seattle. **Basil McHugh** has been promoted from assistant to city engineer at Renton, succeeding **James E. Morrison,** who will continue as manager of public utilities.

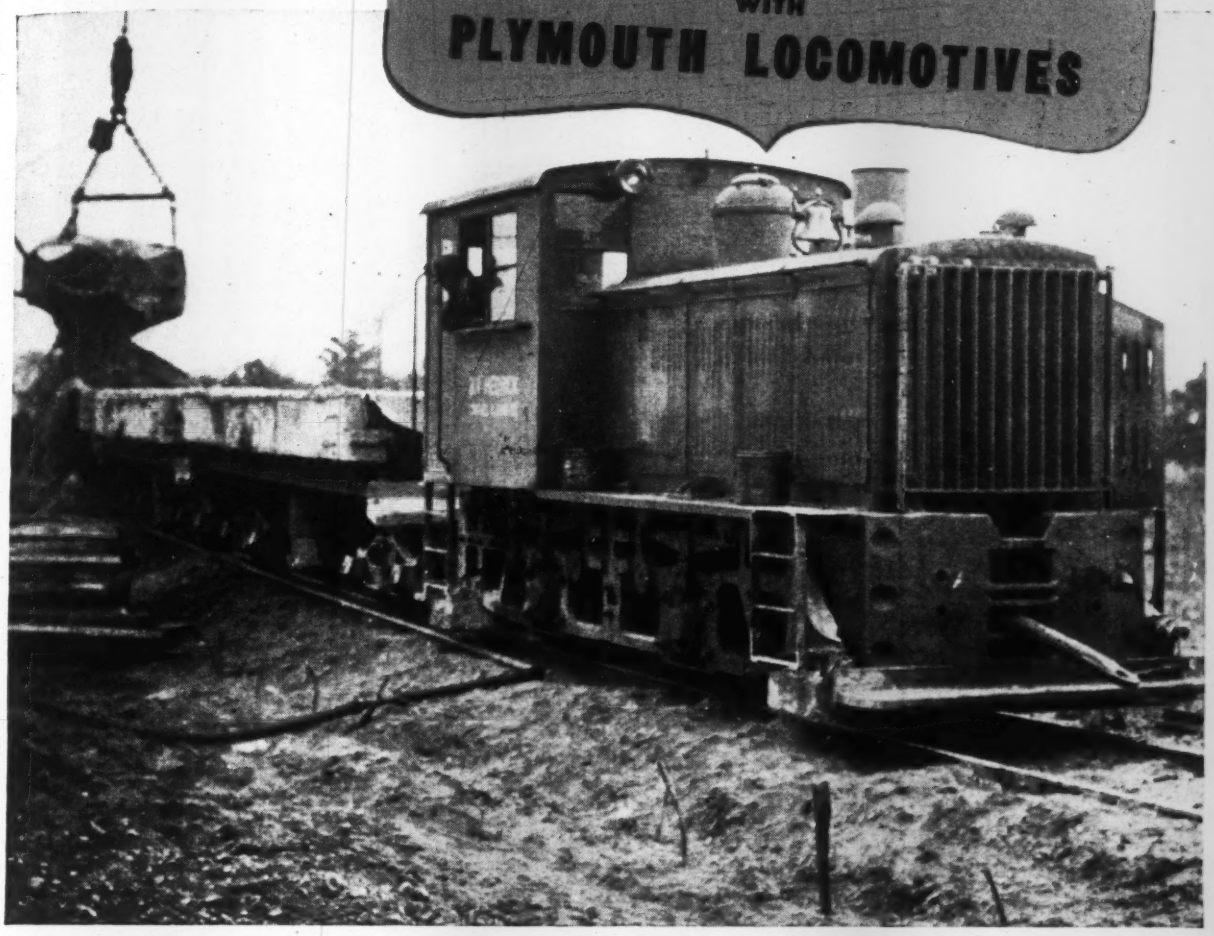
Frank M. Williams, Columbus, has been named assistant chief engineer of the Ohio Highway Department. He resigned as Ohio district engineer for the Clay Sewer Pipe Association of Columbus to accept the new post.

S. P. Darlington, former member of the War Production Board in charge of power to the Pacific Northwest, has joined Florida Power Corp. as resident construction engineer for the power plants now under construction at Inglis and Ben Springs. Dr. Darlington received his doctor's degree in mechanical engineering at the Sheffield School of Engineering at Yale University. In July, 1921 he joined Public Service Electric & Gas Co., Newark, N. J., and from February, 1925, to July, 1927, was with Florida Power Corp. His last position before joining the Florida utility was with General Foods Corp. in New York.

Mark Brataas has been appointed southeast engineer of the Minnesota highway department, at Rochester, succeeding the late E. V. H. Brown.

William H. Collison, Jr., of Ocean City, N. J., has been appointed consulting engineer for Avalon. Mr. Collison serves in the same capacity for

MORE WORK...IN LESS TIME WITH PLYMOUTH LOCOMOTIVES



The switch to Plymouth Locomotives paid dividends to the B. V. Hedrick Gravel and Sand Company, Lilesville, North Carolina—dividends in the form of more trips per day, easier handling of cars and, most important, oversize construction of all vital parts that cut maintenance costs to the minimum.

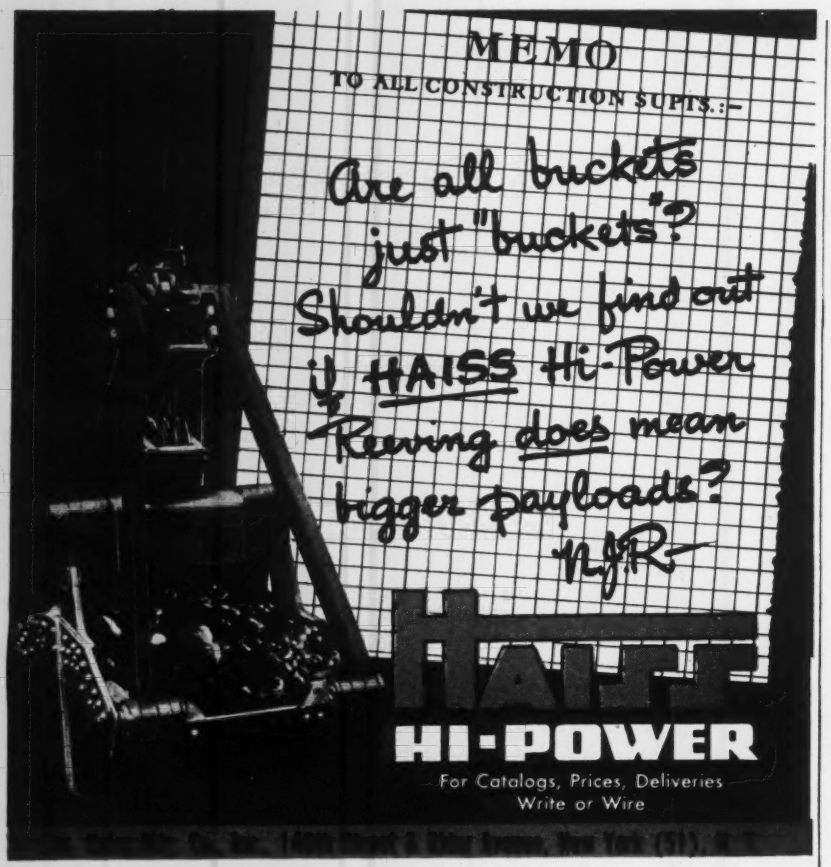
The Plymouth Locomotives on this job make nine round trips daily, hauling six cars per trip. Smooth starts and stops have eliminated spilling of dirt and rock, permit more accurate spotting of cars.

Doing more work in less time — and at lower cost — is characteristic of Plymouth Locomotives. If that's the kind of service you need and want, write for complete details. Address Plymouth Locomotive Works, Dept. A-4, Plymouth, Ohio.

PLYMOUTH LOCOMOTIVES

GASOLINE, DIESEL MECHANICAL AND DIESEL ELECTRIC

PLYMOUTH LOCOMOTIVE WORKS • Division of The Fate-Root-Heath Co., Plymouth, Ohio, U.S.A.



Save up to 40% on equipment Cleaning and Repair Time

WITH

HYPRESSURE JENNY STEAM CLEANER

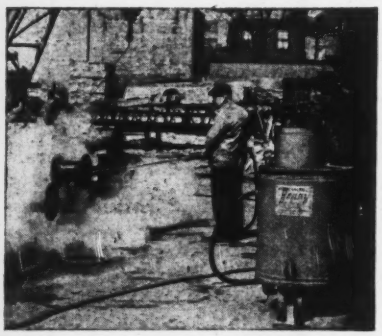
Hypressure JENNY'S mixture of steam, hot water and cleaning compound, applied under pressure through a spray nozzle, removes mud and grease from tools and equipment 8 to 10 times faster than by hand methods. JENNY Steam Cleaning *before* repairs saves up to 40% of mechanics' time usually lost wiping dirt and grease from parts and machinery.

The following are typical savings Hypressure JENNY is effecting for hundreds of users*:

"We save $25.00 on each piece of equipment we clean with Hypressure JENNY."

"It used to cost $140.00 to clean a shovel and took one week's time. Now we do a better job in two days at a cost of $60.00."

**Names on request.*



Hypressure JENNY is sturdy . . . compact . . . portable . . . economical . . . easy to use. Oil or gas fired units are optional. Only requirements for operation are an electric current outlet and hose connection to water supply.

Write for illustrated folder and complete information on how Hypressure JENNY can save *you* time and money.

HYPRESSURE JENNY DIVISION
HOMESTEAD VALVE MANUFACTURING COMPANY
P.O. BOX 31 CORAOPOLIS, PA.

several other Cape May county communities.

Gov. James H. Duff of Pennsylvania has re-appointed **Ray F. Smock** as state secretary of highways for a 4-year term. In 1912 Mr. Smock and a partner formed the Keystone Construction Co. with which he was associated for 21 years. He became Pennsylvania Assistant Secretary of Highways in November, 1943, which position he held until March 21, 1946, when he was appointed secretary.

Pennsylvania's Highway Department has announced the resignation of **Stanley D. Triplett,** of Tyrone, as senior materials engineer at the Harrisburg headquarters of the department, and **J. Donald Port,** of Butler, resident engineer in District No. 10 at Indiana, Pa.

Harry E. Wilson, Peoria, Ill., has been appointed city engineer of Peoria, Ill., succeeding Robert R. Herwig who left to join the consulting engineer firm of Leiter and Associates, Peoria. Wilson had served as assistant engineer and latterly was employed by the Toledo, Peoria, and Western Railroad Co.

Lyman R. Flook, Jr., a graduate of the University of Michigan, 1943, is supply engineer for the Rio Grande project. Previously he was with the Bureau of Reclamation in Pueblo, Colo.

Robert Lee Morrison has been elected city manager of Knoxville, Tenn. He is district engineer of the FWA at Knoxville but he is expected to resign soon to take over his new duties. He was sent to Knovxille in 1935 as WPA district operations director. He was graduated from North Carolina State College in 1911 with a civil engineering degree.

John A. Diven has been appointed assistant roads engineer of Baltimore county, Md. He has been with the state roads commission for 16 years.

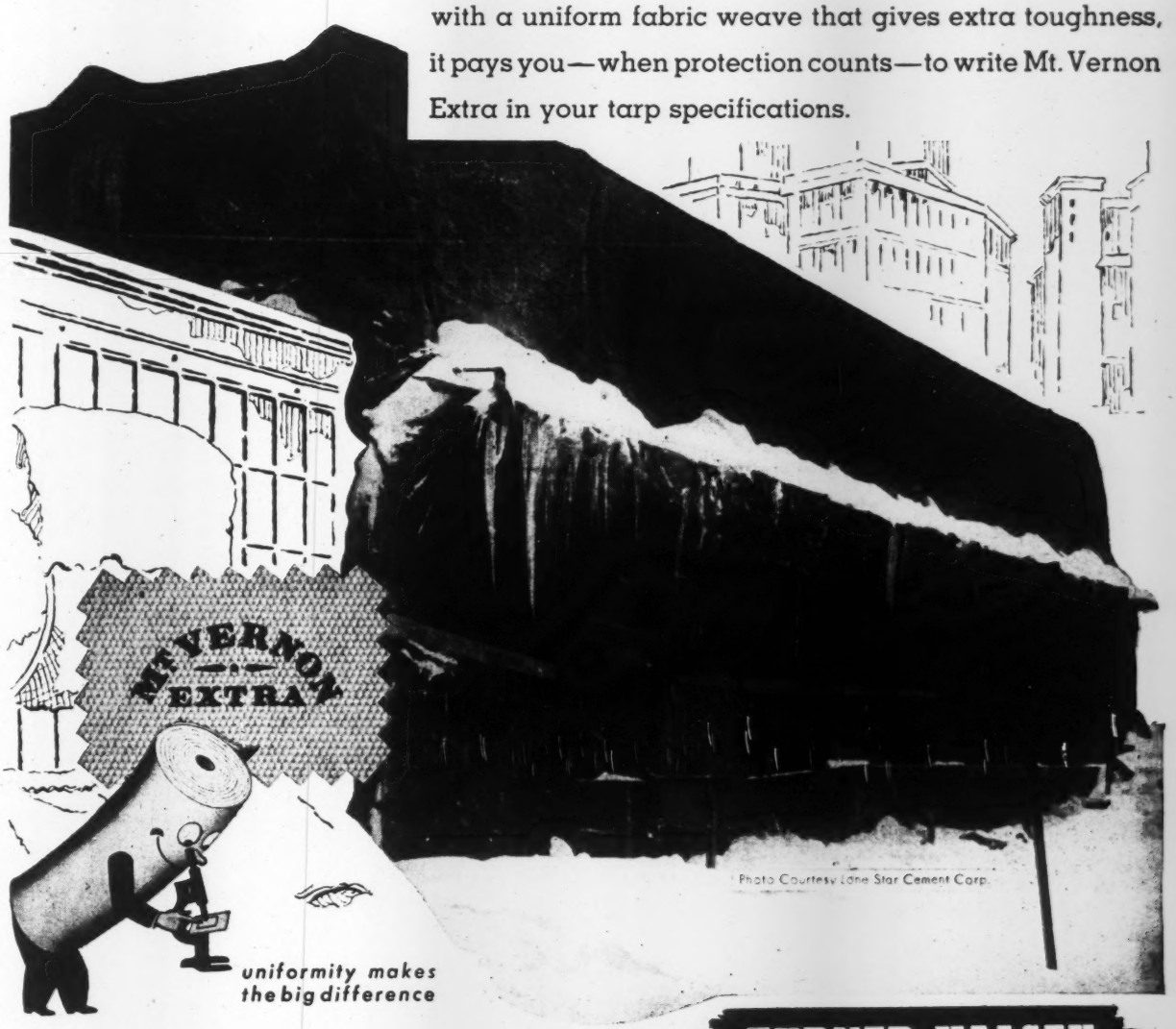
Hamilton G. Grady and **Leslie G. Jost** have formed a consulting structural engineering partnership, Grady and Jost, in Los Angeles, Calif. Grady, who served as lieutenant commander in the Seabees and also saw duty in World War I, served as structural engineer for contracting companies on Shasta and Boulder dams, also working for a number of contractors in and around Los Angeles. He is a graduate of the University of Pittsburgh. Jost, a graduate of McGill University, Montreal, served as structural and chief engineer for Consolidated Steel Corp. of Los Angeles for nine years

WHEN PROTECTION COUNTS...

Specify Mt. Vernon Extra

Protecting a job from the blasts of winter tests the strength and weather resistance of tarps. But tarps made of Mt. Vernon Extra duck have the stamina to stand up under the worst of weather and wear.

Because Mt. Vernon Extra is made of top grades of cotton with a uniform fabric weave that gives extra toughness, it pays you—when protection counts—to write Mt. Vernon Extra in your tarp specifications.



Mt. Vernon-Woodberry Mills

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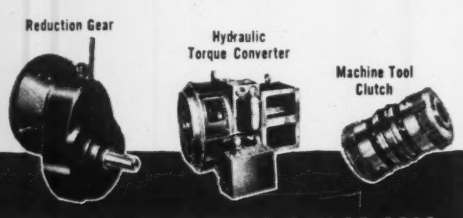
Fluid

"TAKES THE RAP"

Heavy-duty construction equipment is expected to take a mauling . . . to stand up under battering shocks and strains . . . day in and day out . . . under the toughest conditions. When there's a Twin Disc Hydraulic Coupling in the power train, the full weight of the shock loads never reaches the driving or driven parts . . . the fluid principle of the Coupling absorbs and cushions the destructive forces that wreck equipment.

This "shock absorption" lengthens the life of engines, cables, gears, booms, buckets . . . reduces "downtime" and maintenance costs . . . makes it easier on operators to handle a rig equipped with a Twin Disc Hydraulic Coupling.

Write today for a copy of Bulletin 136 for the details of the Twin Disc Hydraulic Coupling. TWIN DISC CLUTCH COMPANY, Racine, Wisconsin (Hydraulic Division, Rockford, Illinois).



TWIN DISC
CLUTCHES AND HYDRAULIC DRIVES

SPECIALISTS IN INDUSTRIAL CLUTCHES SINCE 1918

and later was structural engineer for the city in the division of bridge and structural design.

Raymond Birchett of the Mississippi River Commission and 15 years with the U. S. Army Engineers, a colonel in the European theater, has joined with Frank P. Gates to form the firm of Gates-Birchett, engineer-architect, at 700 Chickasaw Avenue, Jackson, Miss.

James P. Dodge, of the North Carolina State Highway & Public Works Commission, Raleigh, N. C., who recently returned after six years service in the Army, has been appointed safety highway engineer.

Vincent T. Young is now head of structural design, engineering division in the Denver, Colo., district of the U. S. Engineers, his present assignment being on the Cherry Creek Dam and Reservoir, flood control projects, and military projects. Educated at the University of Nebraska and the Polytechnic Institute of Brooklyn, he started to work for the U. S. Engineers, War Department, in March, 1934, under the Kansas City district as an inspector of construction on the Missouri River channel improvement. He was later with the Savannah, Ga., Binghamton, N. Y., Syracuse, N. Y., and New York City districts.

Walter L. Lovejoy, city engineer at Hoquiam, Wash., for 25 years, has been succeeded by F. D. Esterbrook who, as a lieutenant, supervised naval construction at nearby Moon Island airport during the war.

Sam Watkins has become a member of the Medford, Ore., consulting engineering firm of A. D. Harvey & Associates.

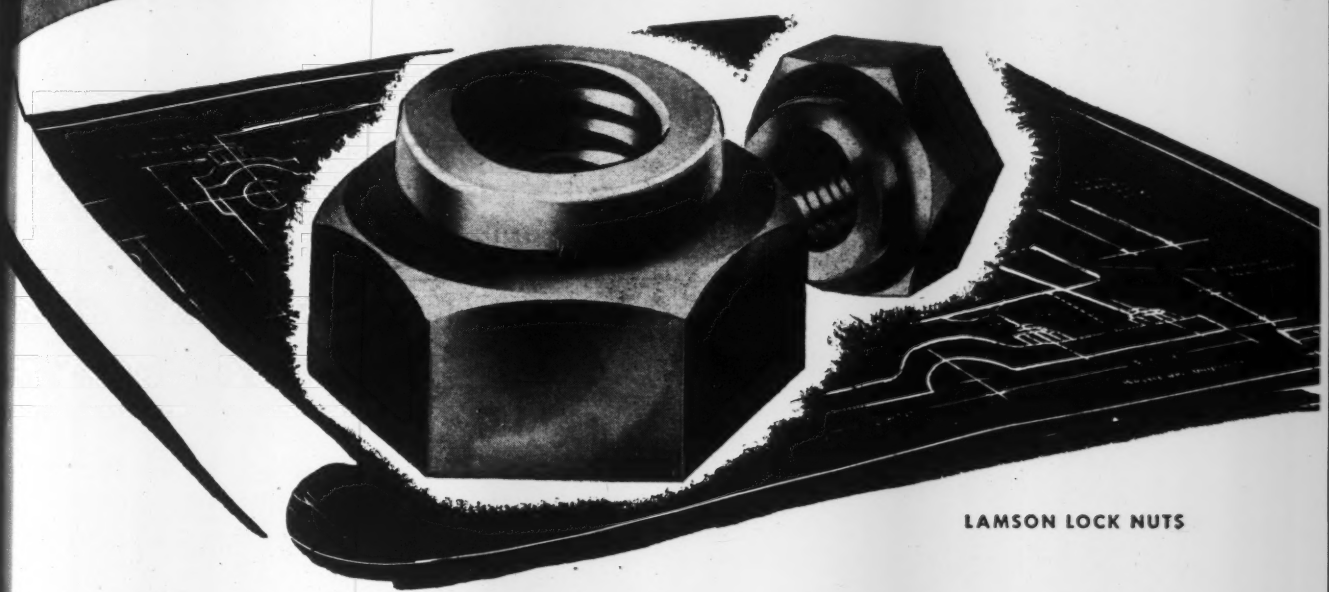
Walter John Manning, of Quebec City, has been named by Dominion Ministry of Transport as marine agent for the department, succeeding H. J. Kaine, retired. Mr. Manning was formerly on the engineering staff of the Department of Public Works and later district engineer.

John Bright, U. S. Public Health Service director of communicable disease division at Jackson, Miss., has been made city engineer and city secretary of West University Place, near Houston, Tex. He has an engineering degree from the University of Texas and served six years with the Texas State Highway Department.

Thurston R. Quarles has been appointed county engineer and county surveyor of Hill County, Tex.

ay we "Butt in" on your Blueprints

nd perhaps solve your Fastener Problems?



LAMSON LOCK NUTS

YOU have high hopes for that new product of yours. It has what it takes to succeed in a big way. Utility, sales appeal and it's priced right. Your engineers and designers have seen to that.

But how are you going to assemble it most efficiently? What *types* of nuts and bolts and screws will do the job *right* . . . and at *lowest cost?* For instance, will you be able to use so-called "STANDARD" fastenings . . . types that are used on thousands of other products? Or will your new product require one or more "SPECIAL PURPOSE FASTENINGS" . . . such as the all-steel, one-piece Lamson Lock Nut illustrated above, or one of the products on the opposite page?

Choosing the proper fasteners for a product is an exact science in itself. It takes a whale of a lot of "know how" to select, out of the thousands of fasteners available, the particular one which meets all your requirments economically.

Whenever you are faced with a problem involving the proper choice of bolts, nuts, screws or allied products, LAMSON & SESSIONS invites your inquiry, without obligation. As one of the largest bolt and nut manufacturers in the United States, backed by 81 years' experience in the industry, we are in an excellent position to solve your fastener problems quickly—in fact, the answer may already be in our files.

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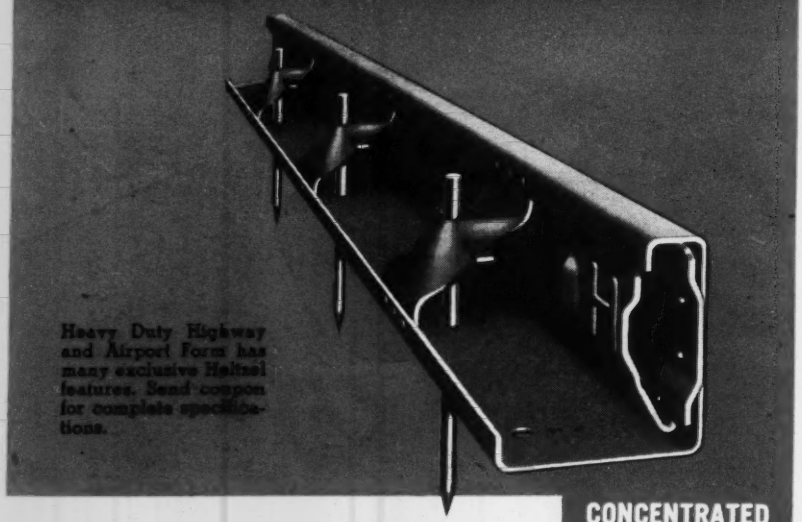
build better with

HELTZEL STEEL FORMS



Heavy Duty Highway and Airport Form has many exclusive Heltzel features. Send coupon for complete specifications.

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HIGHWAYS

CURBS

CURB AND GUTTER

SIDEWALK

AIRPORT

The heavy duty highway and airport forms have several exclusive Heltzel features . . . 2½" tread . . . up-turned base flange — 50% additional strength . . . extended lock joint guide . . . hot pressed ¼" lock joint — V type eliminates clogging . . . non-clogging single wedge stake pockets that are not affected by vibration. The base flange is also drilled for auxiliary stakes or bolting on risers. The $\frac{7}{32}$" form is recommended for all construction up to 20' widths. The ¼" form is recommended for construction over 20' in width. Both forms meet all highway specifications.

Heltzel also has steel forms for curb, combined curb and gutter, sidewalk, rigid radius and flexible radius.

Heltzel Steel Form & Iron Company, Warren, Ohio

SEND ME STEEL FORM CATALOGS:

[ ] B-19 Steel Highway and Airport Forms

[ ] B-19A Steel Dual Duty Airport Forms

[ ] A-20 Steel Forms for Curbs or Curb and Gutters or Sidewalks.

Name_____

Address_____

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(Type of construction usually engaged in)

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- BINS, Portable and Stationary
- CEMENT BINS, Portable and Stationary
- CENTRAL MIXING PLANTS
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- ROAD FORMS (with lip curb and integral curb attachments)
- CURB FORMS
- CURB AND GUTTER FORMS
- SIDEWALK FORMS
- SEWER AND TUNNEL FORMS
- CONCRETE BUCKETS
- SUBGRADE TESTERS
- SUBGRADE PLANERS
- TOOL BOXES
- FINISHING TOOLS FOR CONCRETE ROADS

HELTZEL STEEL FORM & IRON CO. WARREN, OHIO · U. S. A.

John L. Padgett, former Hawaii territorial highway planning engineer, is now chief engineer for Hawaii. He is a World War I naval officer, and a graduate of the Polytechnic College of Engineering, Oakland, Calif., and Stevens Institute, Hoboken, N. J. He was a general contractor and held various construction positions until he joined the territorial highway department in 1935. He succeeds **E. L. Wung,** resigned.

Norman G. Goebelle has been appointed city engineer and building inspector of Galt, Ont., having been acting city engineer since May, 1946.

Russell Van Nest Black of New Hope, Pa., has been retained by the City-County Planning Committee at Winston-Salem, N. C., to make a planning survey there.

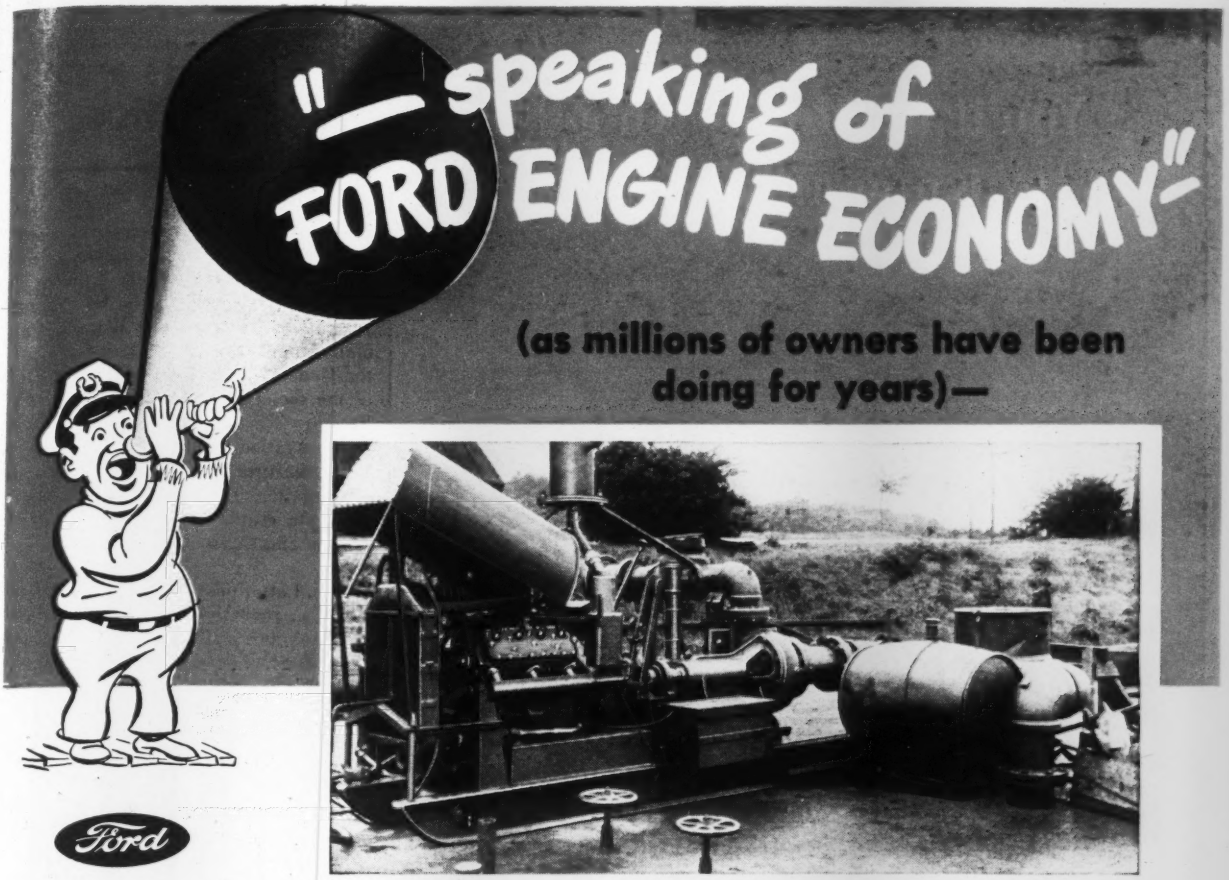
Howard R. Kruse has been appointed city engineer of Kaukauna, Wis., to succeed **Frank M. Charlesworth,** who is now Outgamie County surveyor.

William Raywood Smith, who retired recently as county engineer, Middlesex County, London, Ont., has been appointed a special consultant to the Ontario Department of Planning and Development on conservation projects. Mr. Smith will continue his private engineering practice but will also serve as a special liaison officer between the department and municipalities considering the carrying out of conservation projects. His first task will be to make contact with the various municipal bodies in the watershed of the Thames River of southwestern Ontario.

Lorne A. Campbell, C. E., managing director of the West Kootenay Power and Light Co., Ltd., Trail, B. C., has won the Sir John Kennedy Medal senior award of the Engineering Institute of Canada.

Nichols Engineering & Research Corp., N. Y. City, has announced the appointment of **F. B. Schilling,** as vice-president in charge of sales and general manager; **R. W. Rowen,** as vice-president in charge of engineering and research and **S. Burgess** as vice-president in charge of field operations.

K. M. McGhie, of Rochester, Minn., professional engineer, with the Minnesota Highway department for 18 years, has established his own engineering office at Rochester. His last position with the highway department was district soil engineer. He will specialize in land, topographic and soil surveys, and plans for roads, streets, airports, waterworks and sewers.



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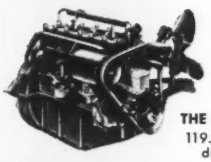
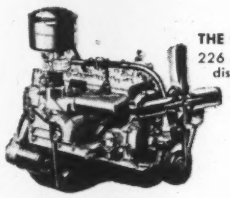
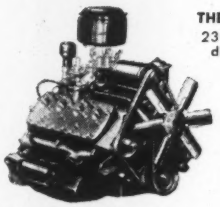


THE 40-H.P. FOUR
119.5 cubic inches displacement



THE 90-H.P. SIX
226 cubic inches displacement



THE 100-H.P. V-8
239 cubic inches displacement

Berard Bros. Towing Co., of New Iberia, La., operates four tugs and nine barges, transporting crude oil. The cost of pumping, cited above by Mr. B. J. Berard, includes labor. In a letter, Mr. Berard adds, "In our many years of crude oil barge transportation we have yet to encounter any pumping unit to equal the economy and performance we now get."

Efficiency, reliability and economy such as this—backed by famous Ford Service everywhere—explain why so many builders of engine-powered equipment have standardized on Ford-built engines. Any electric generating unit, compressor, road and paving machinery, irrigating and fire-fighting unit—any such equipment that must go out "on its own" and pay its way in performance—is well powered when it's Ford-powered. Write for detailed data. Address—

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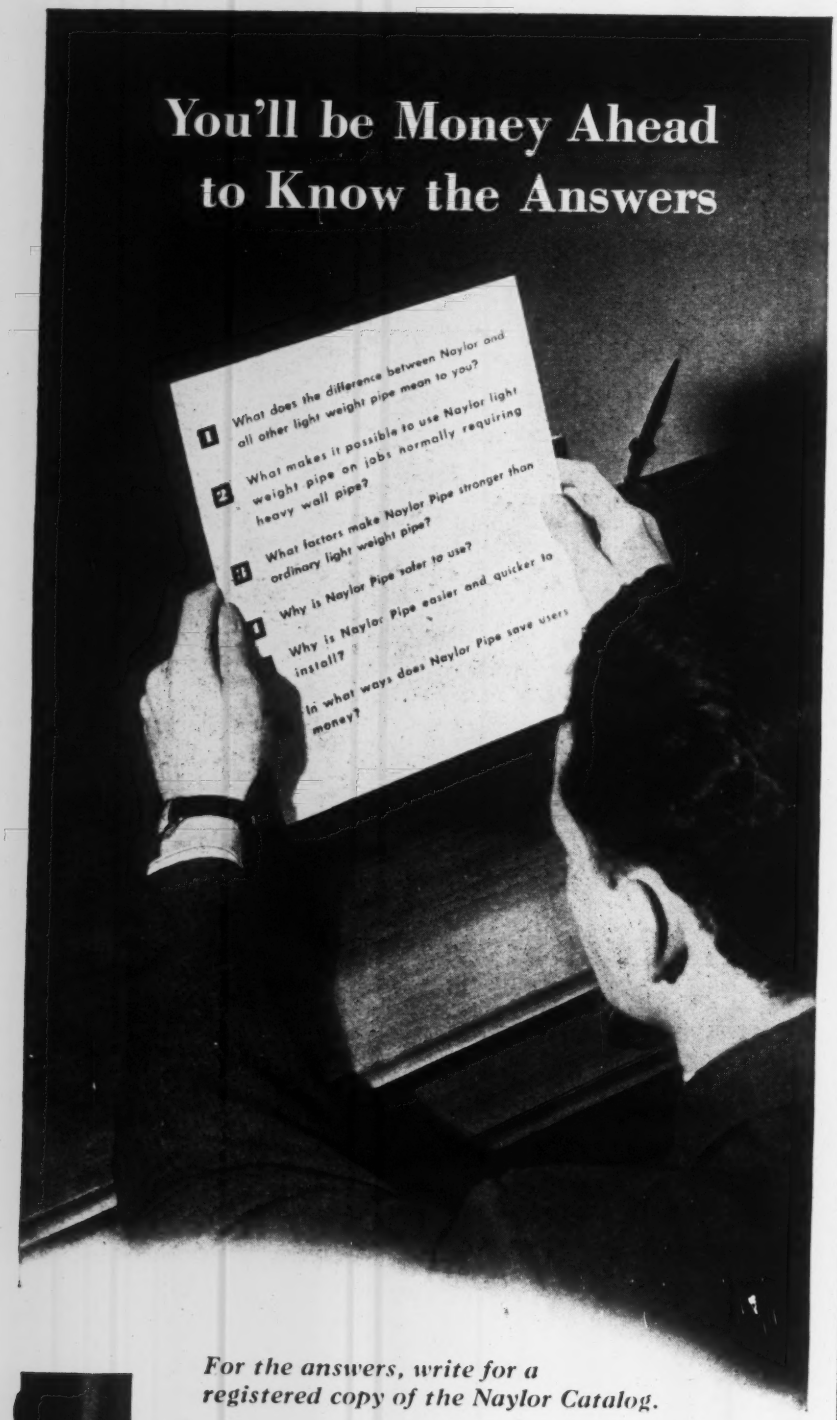
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Elections and Activities

C. A. Betts, civil engineer with the U. S. Forest Service, Washington, D. C., has been elected president of the Washington Society of Engineers for the year 1947. He succeeds A. F. E. Horn, manager of the Washington office of the General Electric Co. Other officers of the society for the coming year are: Vice-president, T. R. Tate, Washington representative of the Charles T. Main Co.; treasurer, B. F. Locraft, civil engineer; and secretary, A. N. Carter, associate editor of *Engineering News-Record* and *Construction Methods*.

J. E. Latta, president, Latta Construction Co., recently was elected president of the Municipal Contractors' Association of St. Louis, Mo. Other officers elected are: vice-president, J. F. Ansbre; secretary, Ellsworth Appel, and treasurer, Vincent Micette. R. L. Murphy is manager of the association, which is composed of contracting firms engaged in public construction. Its offices are at 511 Locust Street, St. Louis 1, Mo.

John H. Sellen has been elected president of the Seattle chapter, Associated General Contractors. Other officers are Walter W. Harfst, first vice-president; M. P. Butler, second vice-president; James Cawdry, secretary, and Howard Lease, treasurer. Named to the executive committee were Don Mowat, W. G. Clark and J. B. Warrack.

A Southeast Georgia chapter of the Georgia Society of Professional Engineers has been organized at Waycross with R. L. Pittman, Waycross, president; R. L. Littlefield, Jessup, vice-president; Harrison D. Watts, Jr., Waycross, secretary-treasurer; E. A. Logan, Ocilla, state representative. W. L. Lee, Valdosta; H. J. Friedman and C. P. Chapman, Brunswick; L. R. Tabor, Waycross, were named directors.

Maj. Blase Nemeth, Corps of Engineers, has been elected president of the Jacksonville, Fla., Post, Society of American Military Engineers.

Other new officers of the post include J. L. Ingram, first vice president; L. L. Burnet, second vice president; N. A. Holman, secretary, and A. H. Brown, treasurer, John F. Reynolds, retiring president, James L. Hayden and L. O. Thornburg compose the new directorate.

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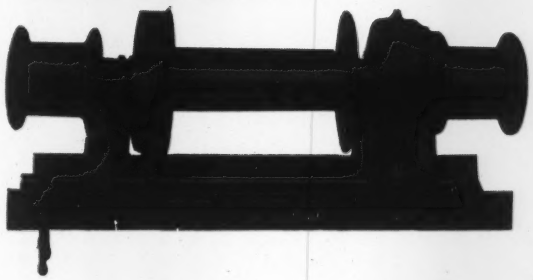
for Tough Handling Jobs!

BRADEN MODEL M9-18B



This NEW Braden Model is engineered for extra tough handling jobs that require the utmost in safety and ease of operation. The M9-18B will handle loads up to 18,000 lbs. with a safety factor of 3 plus. It is designed for 1½ and 2 ton trucks and comes complete with full cab controls. The M9-18B has, as standard equipment, the New OIL-COOLED FULLY ADJUSTABLE, AUTOMATIC SAFETY BRAKE which makes it the safest truck winch on the market within its rated capacity. All Braden Winches can be had with the sensational NEW 2 speed forward and 2 reverse speed drive which the winch operator has waited for for the past twenty-five years.

Write for Complete Catalog for Information concerning the entire Braden "M" Series truck winches.

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BRADEN Winches

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Oklahoma

Dunking's good for doughnuts,

BUT DON'T DEPEND ON IT FOR WOOD

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The Lake County, Ill., chapter of the Illinois Society of Professional Engineers has elected the following: Chester L. Domke, president; Elmer G. Pope, vice-president; Richard Tracker, secretary-treasurer, Henry B. Buck is chapter representative for the state board of directors.

W. C. M. Butler has been elected president of the Associated Pennsylvania Constructors. Other officers are: vice-president at large, Herman Rieke; chairman executive committee, Edward A. Daylor; treasurer, G. Howard Brown; and A. E. O'Brien re-elected executive secretary.

C. Earl Colomb has been re-elected president of the New Orleans, La., chapter of the National Association of Home Builders.

Albert Hutchison has been elected president of The Engineering Association of Nashville, Tenn. Other officers are: Allan Sharp, vice-president; John S. Herbert, secretary-treasurer; and E. E. Litkinhous and K. C. Hardenstle, Jr., director.

J. F. Matthews has been re-elected president of the Susquehanna River System Flood Control Association; T. J. Nelley, vice-president; and E. V. Allison, executive secretary.

The Grays Harbor Technical Engineers & Architects Society has elected Richard Rowland of Cosmopolis, Wash., as president, with Frank Haaga, Hoquiam, vice-president; Perry C. Briggs, delegate, and Charles C. Kirkwood, alternate delegate to the Central Labor Council. Kenneth Horton, Hoquiam, was re-elected secretary-treasurer.

Newly-elected officers of the Harrisburg Chapter of the Pennsylvania Society of Professional Engineers are: J. Donald Carpenter, president; George M. Arisman, vice-president and Russell E. Conrad, director. Guy R. Johnson, was the retiring president.

The officers and directors for 1947 of The Associated General Contractors of Illinois are: President, Fred W. Snappert, Jr.; vice-president, P. F. Loiselle; and treasurer, Thomas H. Joyce, Jr. The directors are: Frank C. Feutz, T. E. Fieweger, A. C. Hoeffken, W. H. Kewley, Norman R. Jansen, H. H. Hall.

Officers of the North Carolina Society of Engineers have been elected as follows: W. Paul Lyman, Raleigh, president; R. P. Reece, Winston-Salem and L. M. Keever, Raleigh, secretary-treasurer.

to support this Big ALL-STEEL Pier

Low tide *reveals wooden pile remnants of a former pier. Note that new steel pier was located further off shore, in deeper water.*

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Engineering School News

Enrollment of students in engineering courses continues to beat all records. Some of the latest figures are as follows: At the University of Illinois, Urbana, the increase in civil engineering students is from 129 in the school year of 1945-46 to 451 this year; of the total of 4,051 students in the college of engineering at the University of Texas, 528 are studying civil engineering; Purdue University at Lafayette, Ind., claims the largest engineering school in the world with 7,000 students on the campus and nearly 1,000 additional freshmen engineers in extension centers; there are now 1,547 engineer students at McGill University, Montreal.

Gerard A. Barba, engineer-estimator for the Edward E. Bray Construction Co., Bridgeport, Conn., has been appointed instructor in cost analysis and estimating of building construction at the evening sessions of the Junior College of Connecticut. The course will embody scientific estimating procedures and cost control techniques for commercial and residential construction. Mr. Barba was graduated from Tri-State College with a degree in civil engineering.

A highway engineering conference will be held at the Ohio State University, Columbus, March 18-19, sponsored by the department of civil engineering of the Ohio State University and the Ohio Highway Department.

A $3,371 contract covering soil explorations and foundation investigations at the site of a proposed agricultural engineering building at Cornell University, Ithaca, N. Y., has been awarded to the MacArthur Concrete Pile Corp., New York City, by Charles H. Sells, State Superintendent of Public Works. Data obtained will be used in the design of the new structure, estimated to cost $1,260,100.

The Massachusetts legislative committee on agriculture has approved the expenditure of $1,500,000 for enlargement of engineering facilities at Massachusetts State College. Hugh P. Baker, president of the college, says that there is great need for enlarging facilities for engineering education facilities for veterans. At Fort Devens, where veterans are taking college grade subjects, has 549 students majoring in engineering for whom there are no facilities for advanced study.

Harry N. Lendall, chairman of the department of civil engineering and professor of municipal and sanitary engineering at Rutgers University, has been appointed to serve as a member of the New Jersey State Board of Health. Professor Lendall has been on the Rutgers faculty since 1912.

The Alabama Polytechnic Institute has added to the department of engineering: Robert N. Campbell, assistant professor of aero engineering; Henry J. Porter, III, instructor in engineering drawing; James M. Jones, instructor in civil engineering; Vernon K. Gunkel, assistant professor in mechanical engineering; and Emil R. Hargett, instructor in civil engineering.

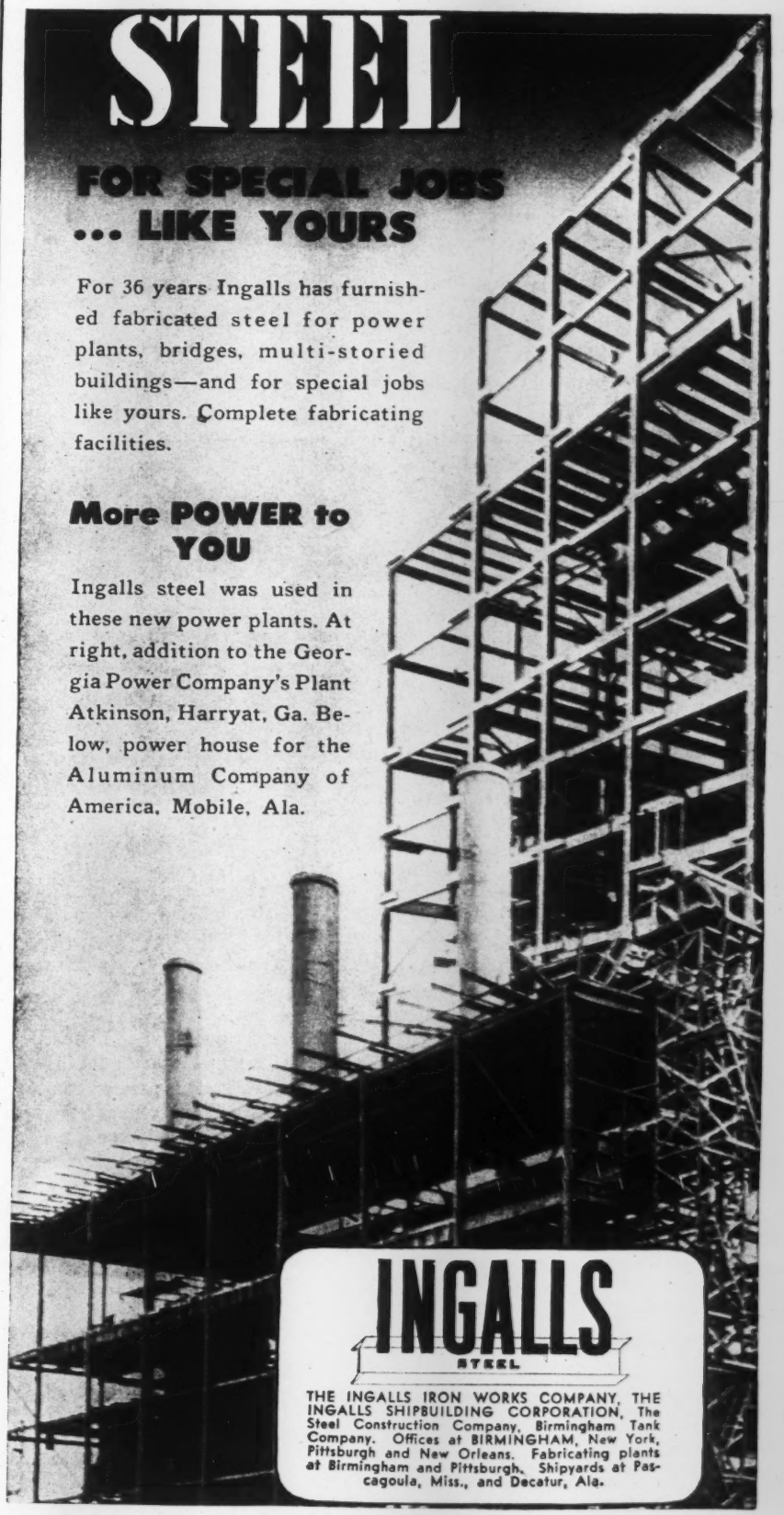
Ford L. Wilkinson has resigned as dean of the Speed Scientific School at the University of Louisville, Ky., to become academic dean of the Navy Postgraduate School at Annapolis, Md. He is a graduate of that school. During his nine years at Speed the enrollment at the school has doubled and a new engineering building was constructed.

Ray W. Meisenhelter, 62, an officer veteran of both world wars, is completing at James Millikin University, Decatur, Ill., his engineering education which he began in 1906 at the University of Illinois. Between the two wars, he was engaged in engineering and construction work. He is now a junior at Millikin. He is the father of two World War II veterans, one of whom expects to start an engineering course at the same institution next fall.

Herman Blicksderfer, who has been associate professor of civil engineering at the University of Idaho, Moscow, Ida., has become a professor of civil engineering in Bradley University, Peoria, Ill. He obtained his bachelors' and master's degrees from the Missouri School of Mines, Rolla, Mo., and served on the engineering staffs of the Illinois and Wisconsin state highway commissions, as assistant professor of civil engineering, University of Texas, and as engineer with the United States Soil Conservation Service. During the war he worked for the government in airport design.

Civil engineer graduates of the University of New Hampshire are going to know how to do a welding job, as students in civil engineering all have to take the forging and welding course.

Graduate courses in civil engineering leading to master of science and doctor of philosophy degrees are offered at Illinois Institute of Technology.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The NEW PB-8 is a real time-saver. A new-type, double-kicker port valve and a sturdy block piston give it greater hitting power... Full air cushioning guarantees long life... Throttle selectivity permits easy starting ... Four-bolt handle construction assures rigid joints... Controlled lubrication guarantees smooth, economical operation... Longer handles mean larger gripping surface and greater ease of handling... A long anvil block bearing assures correct alignment... Fronthead springs and bolts are extra strong.

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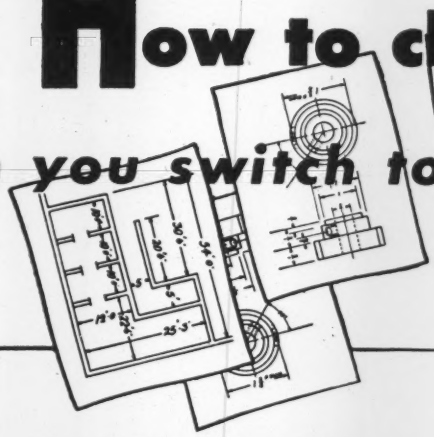
How to choose WISELY

when you switch to Black Line Prints



Choose Simple Equipment

When you change to Direct Process Black Line prints, be sure your equipment is simple—easy to operate. Bruning BW Printer-Developers have no complicated mechanism, no unnecessary "gadgets" . . . are compact in size, not bulky or unwieldy. Even the largest BW Printer-Developer requires only one operator—and there is a size of Bruning Printer-Developer for every need. Prints are made in seconds—delivered ready for use.

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At present, you may be interested only in regular black line prints—but be sure your equipment is versatile enough to care for future needs. With Bruning Printer-Developers, you can make a wide variety of different prints, including BW Film, for salvaging worn or soiled tracings, and BW Colored Line Prints on white or tinted backgrounds (see list below).

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With 45 years of experience in analyzing printmaking needs, Bruning is equipped to give you continuing service. When you buy BW equipment, we do not consider it a "one time sale" since our representatives offer everything for the engineer and draftsman and are thus interested in your complete satisfaction.

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4. A complete line of printing and developing machines to fit every requirement.
5. A continuing service . . . because Bruning sells *everything* for the engineer and draftsman, not just BW equipment. Buying a BW machine is, therefore, not a "one time sale."
6. Continuing research and development in the customer's interest.

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Manufacturers' Activities

MANUFACTURERS AND DISTRIBUTORS of special equipment for Chevrolet trucks, in cooperation with the Detroit zone of the Chevrolet Motor Division, will hold a special equipment show Feb. 25-27 in Convention Hall. Equipment on display will include many types of standard Chevrolet trucks and bodies, as well as a wide variety of bodies and equipment for special use. Truck operators are invited to visit the show, where they will find an unusually complete array of Chevrolet trucks with special bodies, axles, trailers and equipment for every hauling need.

LEROI CO., Milwaukee, Wis., manufacturers of internal combustion engines, portable compressors, engine-generator sets and who specialize in mowing equipment, have just announced that it has purchased the Cleveland Rock Drill Co. of Cleveland, Ohio. The purchase of this company, a division of The Cleveland Pneumatic Tool Co., substantially accelerates the rock drill manufacturing program announced earlier, coincidental with the establishment of Le Roi's Cleveland division. Included in the purchase were the manufacturing rights to all of the line of rock drills, the jigs, dies, fixtures, patterns, etc., as well as the complete inventory of parts for their manufacture. Russ Morgan, formerly secretary and sales manager of The Cleveland Rock Drill Co., who joined LeRoi over a year ago and who was instrumental in the or-

What do you haul?
No matter what the load may be—on or off the road—rain or shine—you're in the right with a rugged La Crosse Trailer.
Field reports have proven that these trailers are built for heavy duty jobs—designed for years of trouble free service—constructed to outlast the average trailer.
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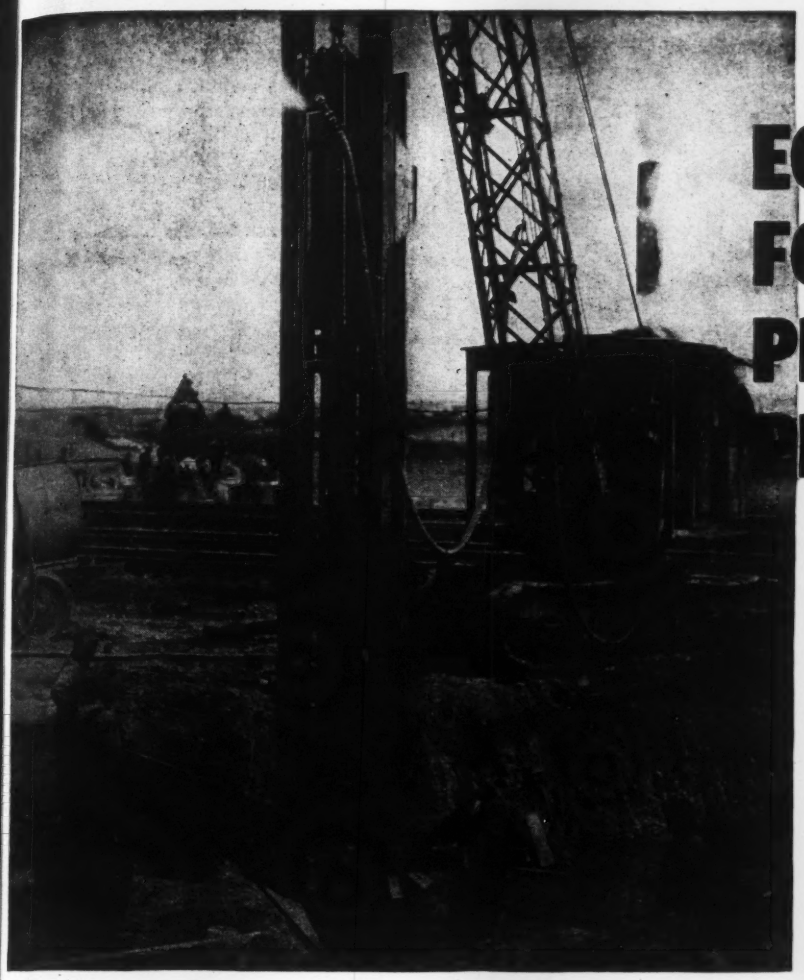


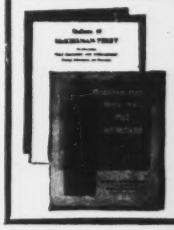
EQUIPPED FOR ANY PILE DRIVING PROBLEM

McKiernan-Terry 9B3 Pile Hammer driving tapered monotube metal piles, on a Batavia, N. Y. project of the Bero Engineering & Construction Co.

Piling material may vary, soil to be penetrated varies greatly, location and working conditions are rarely twice the same. But McKiernan-Terry Pile Hammers are found always ready with the necessary power and dependability, in right sizes, and with every needed attachment for handling any type of pile driving job.

Embodying the widely varied experience of more than forty years of designing, manufacturing and installing pile driving equipment, McKiernan-Terry Pile Hammers and Extractors have become the standard of choice by leading engineers and contractors.

Available in a complete line of ten double-acting and five single-acting hammers, and two double-acting extractors. Extensive facilities of two large plants at Dover, N. J. and Harrison, N. J. assure prompt deliveries.



FOR LATEST PILE HAMMER INFORMATION

Write for McKiernan-Terry Bulletins Nos. 55 and 57, giving complete data on single- and double-acting pile hammers and double-acting extractors.

BLACKSMITH HAMMER BULLETIN
Describes McKiernan-Terry Blacker Hammer, which combines electric motor-driven power hammer with blacksmith's anvil in a co-ordinated unit, that enables one smith alone to handle work of a smith and two helpers. Saves time and labor, increases output. Ask for free Bulletin No. 56.

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UNITED STATES STEEL

ganization of LeRoi's Cleveland division, will head the expanded facilities.

THE PERMUTIT CO. announces the election of the following members of its organization as vice presidents: J. D. Yoder, D. J. Saunders, G. N. Proctor, H. L. Beohner.

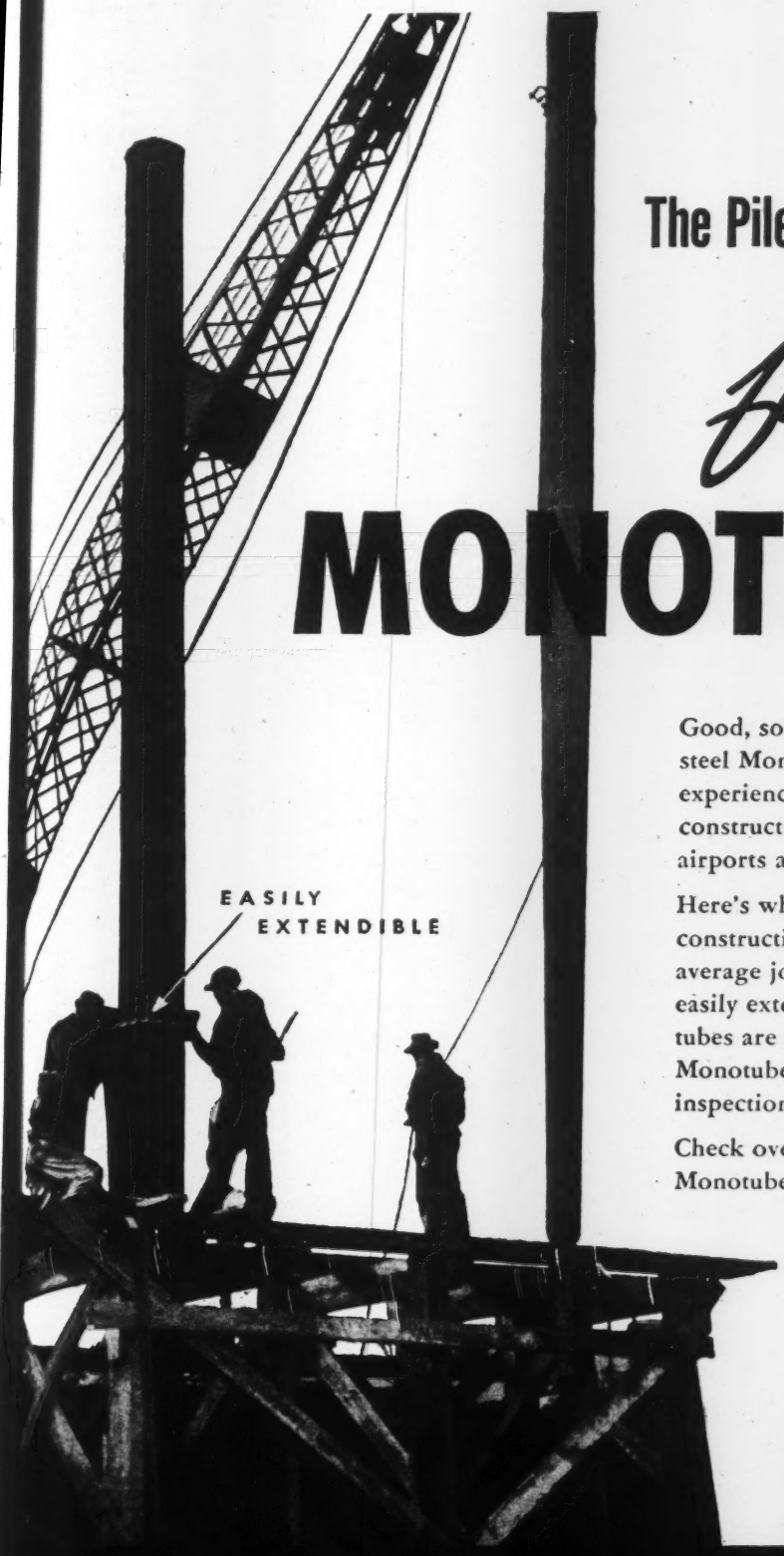
ATLAS STEEL CONSTRUCTION CO. has changed its name to Concrete Forms Corp. The home office is at Irvington-on-Hudson, N. Y., with sales and engineering offices at 43 Cedar Street, New York City. The company specializes in steel plate and sheet metal fabrication, particularly steel forms for heavy concrete construction, such as tunnel forms, bridge piers, wall and flat slab forms, caissons, bins, steel centering, sewer, road and manhole forms.

EMERY L. CLINE and Al G. Freudenburg have been appointed district sales managers for the J. D. Adams Manufacturing Co. Mr. Cline will supervise Adams sales in Texas, Oklahoma, Louisiana, Arkansas, Kansas and Missouri while Mr. Freudenburg will handle Virginia, West Virginia, Pennsylvania, Ohio, Kentucky and southern Indiana.

Formation of NEFF-THOMAS MACHINERY, INC., 1920 N.W. Miami Court, Miami, Fla., has been announced, succeeding P. A. Neff Machinery. The new firm has assumed all assets and facilities of P. A. Neff Machinery and will continue to operate at the same location with the same personnel, in the sale, rental and servicing of construction machinery. A. W. Thomas will act as vice president and sales manager.

GEORGE ABBOT MORISON has relinquished his duties as vice chairman of the board of Bucyrus-Erie Co., South Milwaukee, Wis., to make his home in New Hampshire. He will continue his connection with Bucyrus-Erie as a member of the executive committee of the board of directors.

Three appointments to the executive staff of the ROCKWELL MANUFACTURING CO., Pittsburgh, have been announced: C. A. Wiken, for the past eight years chief engineer of the Delta Manufacturing division in Milwaukee, has been promoted to the position of vice president in charge of engineering for Rockwell. J. E. Ashman has been named controller. A. E. McIntyre, who for the past several years has been manager of the Nordstrom valve division plant in Oakland, Calif., has been transferred to Pittsburgh as general manager of the company's Pittsburgh Equitable Meter division.



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for good!

MONOTUBE!

Good, solid foundations—with tapered steel Monotube piles. That's the choice of experienced engineers and contractors for constructing bridges, piers, buildings, airports and highways.

Here's why: Monotubes' fluted, tapered construction permits faster driving with average job equipment; Monotubes are easily extendible—*right on the job;* Monotubes are light in weight, easy to handle; Monotubes' tubular design makes thorough inspection before concreting easy.

Check over those points. You'll see how Monotubes help make time-and-money savings—how they get construction jobs started *right.* Available in gauge, size, and taper to meet varying soil conditions. For complete information write The Union Metal Manufacturing Company, Canton 5, Ohio.

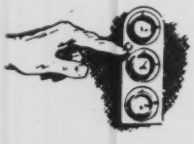
UNION METAL

Monotube Foundation Piles

I Never Knew Diesel Power Could be so Simple to Operate

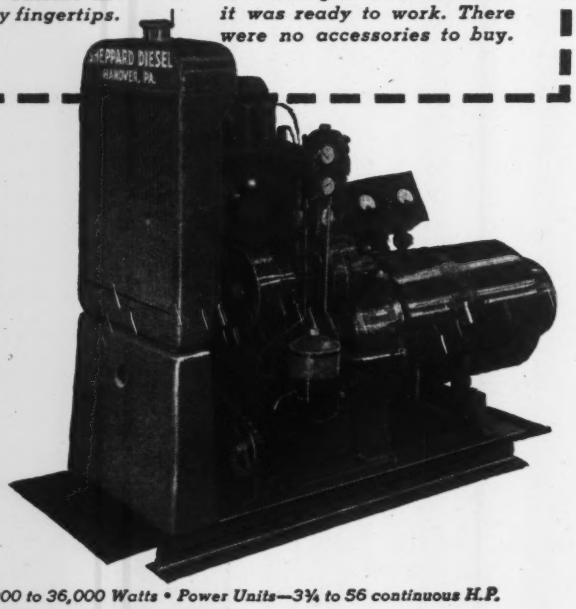
MY SHEPPARD *is a full diesel . . . has no distributor, coil or spark-plugs that need attention and care. Rain won't stop it.*

THE SHEPPARD *Diesel operates and starts on common furnace oil, injected in a solid spray. There is no temperamental carburetor to adjust and maintain.*



I SET *the throttle . . . push a button . . . and my Sheppard is running. Dependable power . . . free from all outside interference is at my fingertips.*

MY SHEPPARD *Diesel was delivered complete. I just put it in place, supplied it with fuel, lubricating oil and water and it was ready to work. There were no accessories to buy.*



Write for the illustrated booklet that completely explains many other outstanding advantages of Sheppard Diesel power units and generating sets.

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Generating Sets—2,000 to 36,000 Watts • Power Units—3¾ to 56 continuous H.P.

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Publications Manufacturers'

Bulldozers and Snowplows—(4-p folder) Describes parallel blade lif mechanism, which is standard equip ment for Trojan bulldozer, V-typ snowplows and reversible one-way snowplows. Specifications are given fo bulldozers for use with International industrial wheel type tractors.—*Con tractors Machinery Co., Batavia, N. Y.*

Packaged Power Unit—(16-p. book let) Describes new unit with electrofluid drive, which consists of general pur pose induction motor, flange-mounted to housing and hydraulic coupling.— *Link-Belt Co., 307 N. Michigan Ave., Chicago, Ill.*

Asphalt Pavement for Parking Areas—(20-p. booklet) Describes off street parking areas, with photos of typical installations. Technical engi neering text tells how to construct these areas. Asphalt thicknesses re quired for different duty conditions are illustrated by typical cross-sections and supporting tables.—*The Asphalt Institute, 801 Second Ave., New York 17, N. Y.*

Cement Stabilizer—(4-p. folder) De scribes Konset, pozzuolanic cement sta bilizer for hydration activation, work ability, curing and color.—*Sullivan Co., Memphis 2, Tenn.*

Preservative Treatment — (4-p. folder) Lists Sulco life preservers for concrete floors, masonry blocks, brick and mortar. With it is sample of water repellent cement mixing powder.—*Sullivan Co., Memphis 2, Tenn.*

Pneumatic Concrete Construction— New bulletin on Presscrete describes pressure injection method of placing concrete for general use and for foundation piles. Concrete mix is conveyed by air pressure through hose and pipe lines to desired location. Particularly adapted to cramped quarters and sub aqueous or subterranean work. For pil ing, steel casing is sunk into ground, earth within it is removed and replaced by concrete forced by air pressure from bottom of vertical injection pipe. As level of concrete forming pile rises, casing and injection pipe are gradu ally withdrawn.—*Presscrete Co., Graybar Bldg., New York 17, N. Y.*

Snow Removal—(4-p. folder) High

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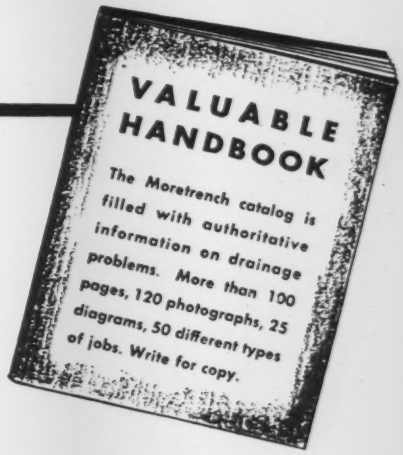
The contractor chose the safest, most economical method known to predrain the excavation—the MORETRENCH WELLPOINT SYSTEM. With the water under control, he was free to construct—in the dry.

Progress on your wet work can be just as sure. A Moretrench Wellpoint System is your guarantee. Our engineering facilities are at your service to plan, estimate, and direct dewatering of your project.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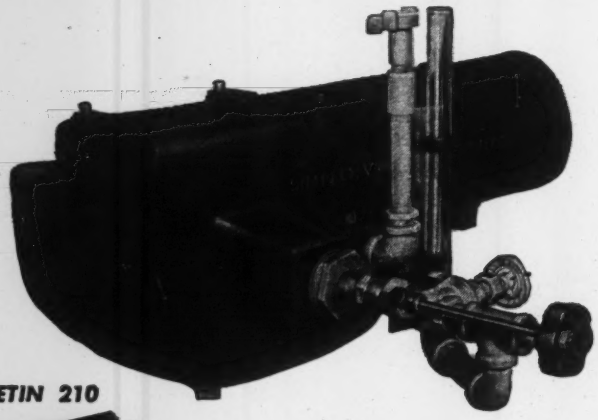

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WRITE TODAY FOR YOUR COPY OF SIMPLEX BULLETIN 210—**describing the operation, installation and capacity of the new SIMPLEX Type-S Parabolic flume. Contains necessary detailed data for design and specification purposes. Address inquiries to Dept. 252.**

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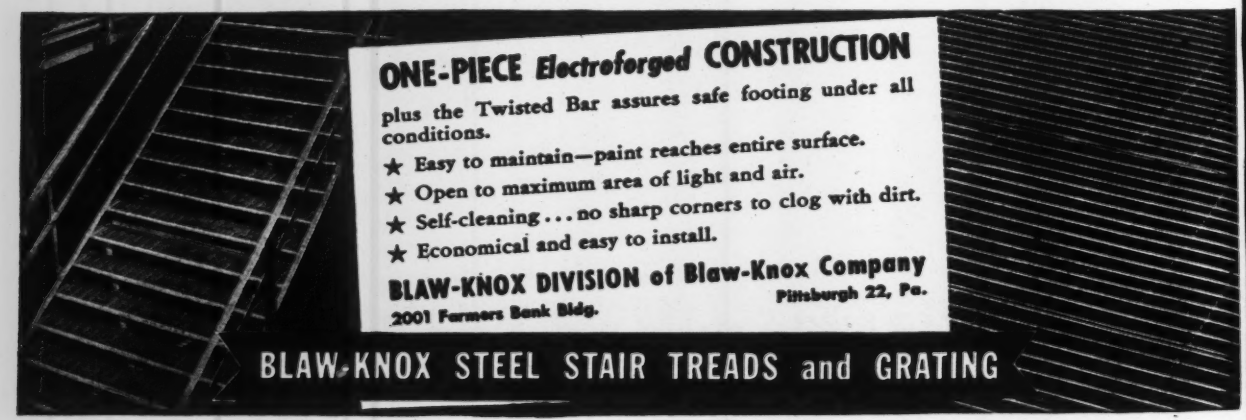
lights attachments which convert m graders into snow removal units. A tion is focused on V-type snow pl mast-type snow wing and reversible way plow and bulldozer for use Caterpillar diesel No. 12, No. 112 No. 212 motor graders. Basic spec cations are given and principal featu of attachments are treated editoria and pictorially.—*Caterpillar Trac Co., Peoria 8, Ill.*

Apron Feeders—(8-p. bulletin) C tains complete specifications on available models, types and sizes standard feeders. Feeders can be fu nished without sideboards, with straig sideboards or with flared sideboards; f drive by gear motor, by conveyor ta shaft, or by crusher. Lengths from to 14 ft. are standard in widths fro 30 to 48 in. Data are given on capac ties, dimensions, weights and hors power. Of special interest is inform tion on how to order to insure rig feeder for job.—*Pioneer Engineeri Works, 1515 Central Ave., Minneapol 13, Minn.*

Industrial Protective Clothing—Tells of new products in this field, pi tures each garment, describes its fun tions in industry, and relates method construction and materials used guarantee maximum service.—*B. F Goodrich Co., Akron, Ohio.*

Truck and Bus Cleaning Manual—(64-p. illustrated handbook) Outline latest methods and materials for pro viding fast, thorough and economica cleaning with minimum labor, with par ticular reference to preventive mainte nance. First part deals with cleaning of motors and chassis, control and pre vention of sludge, cleaning of carbure tors, fuel and water pumps, with sol vents of detergent action. Cleaning o cooling systems and decarbonizing dis mantled parts are also discussed—*Mag nus Chemical Co., Inc., Dept. CM, Gar wood, N. J.*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